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Standing the Heat 4

When director Ron Howard set out to make the ultimate firefighting picture, even he supposed that much of the fiery action in *Backdraft* would have to be accomplished via miniatures and process photography. Special effects supervisor Allen Hall would prove him wrong. Although a handful of visual effects shots would indeed be produced by Industrial Light and Magic, nearly all of the nonstop pyrotechnics would be accomplished live on stage sets and urban locations — with major screen actors working in close proximity to conflagrations of awesome magnitude. *Article by Jody Duncan.*

Rocket Blast 20

To capture on film the adventure and ambience of *The Rocketeer* — Dave Stevens' comic book evocation of Los Angeles during the golden age of aviation — director Joe Johnston assembled a team of ace collaborators including production designer Jim Bissell and special effects supervisor Jon G. Belyeu. A former visual effects art director, Johnston also returned to his alma mater — Industrial Light and Magic — for optical work and miniatures ranging from an eighteen-inch flying superhero to a thirty-four-foot zeppelin. *Article by Mark Cotta Vaz.*

That Old Black Magic 46

Inspired by the period writings of Raymond Chandler and H.P. Lovecraft, *Cast a Deadly Spell* — a made-for-cable feature produced by Gale Anne Hurd for HBO Pictures — infuses the hard-boiled detective genre with unabashed elements of supernatural horror and offbeat humor. Makeup and creature effects — including a passel of gremlins, a living gargoyle and assorted demons large and small — were created by Tony Gardner and his Alterian Studios. Opticals and miniatures — primarily matte paintings and a cataclysmic finale — were provided by 4-Ward Productions. *Article by Kevin Martin.*

FRONT COVER — Fearless flyer Cliff Secord takes to the air in *The Rocketeer*. Firefighter Stephen McCaffrey engages the enemy in *Backdraft* — BACK COVER.

STANDING THE HEAT

article by
Jody Duncan



Backdraft received mixed reviews from both film critics and audiences. For some, the story of sibling rivalry set within the arena of big city corruption and grand scale firefighting was merely the rehashing of a drama already overdone. For others, it was an exciting and long overdue tribute to the fireman. Only the film's harrowing fire sequences were unanimously praised — and deservedly so. Shot with great skill and ingenuity by director Ron Howard and cinematographer Mikael Salomon, they captured the brutality and hypnotic beauty of fire in a manner never before achieved on film. Backdraft also, for the first time, put actors convincingly into the burning maelstrom. It seemed unbelievable, yet there was Kurt Russell — unmistakably the actor himself and not a stunt double — running a mere few feet ahead of a giant ball of fire. Such scenes abounded in the film. Surely some undetectable cinematic trickery was at work.

Yes and no. Early in the project, Howard himself had assumed that most of the fire sequences, for safety reasons, would have to be shot separately and then matted into scenes with the actors. With that supposed 'given' in mind, Howard had enlisted Industrial Light and Magic and visual effects supervisor Scott Farrar to produce forty-some miniature and optical shots. As the project progressed, however, Salomon — who had faced similar challenges as director of photography for *Always* — and special effects supervisor Allen Hall convinced Howard that the majority of the fire sequences could, with careful planning and expert execution, be achieved practically. By the time cameras rolled on location in Chicago, ILM's participation had been pared down to a mere five shots.

Considering the scope of the project, the on-set approach was a daring one. The script, written by former fireman Gregory Widen, featured three massive fire sequences — each different in setting and style — as well as a number of smaller pyrotechnic displays. Widen's story followed brothers Stephen and Brian McCaffrey, played by Kurt Russell and William Baldwin. Stephen is a tough, seasoned firefighter who is both a courageous hero and a risk-taking daredevil. In contrast, Brian is a ne'er-do-well rookie attempting to extinguish the fear and aimlessness that has marked his life since he witnessed his firefighter father's death nearly twenty years before. Stationed with his older brother's company — led by Captain John Adcox (Scott Glenn) — Brian becomes embroiled in a rash of expertly executed arson cases linked to the systematic murder of corrupt city officials.

Within days of being hired to coordinate the film's special effects, Allen Hall was on a plane for Chicago with key members of his crew — first unit effects supervisor Clay Pinney, second unit coordinator Tom Ryba and effects riggers Gary Karas and Joe Montenegro who also led the research and development effort. A veteran special effects man with credits on *Top Gun* and *The Untouchables*, Hall brought with him a wealth of pyrotechnic expertise. However, nothing in his background compared in size or complexity to the Backdraft fire sequences. "It was one of the largest effects shows ever done," Hall noted, "and it was certainly the largest fire show. *Apocalypse Now* had bigger fires, but in sheer quantity and in the attempt to mix fire with sets and actors, this film was a breakthrough."

Hall and his team used their scant three-month preproduction period to research and develop both the aesthetic and the technical aspects of the fire sequences. Determined to surpass the sterile and uninteresting look of fire typically seen in films such as *The Towering Inferno*, Hall

and Pinney reviewed videotapes depicting real firemen fighting real fires. “We wanted to duplicate that gritty realism by pushing the existing technology as far as we could,” said Pinney. “Usually for a movie fire, you come in and slot a pipe, pump propane gas through it, ignite it and put it behind a window to get a sheet of flame. But one of the things Allen taught me a long time ago was that to be successful in doing good effects you have to have three or four layers of things happening. So that’s what we tried to do with the fires. We had smoke elements and two or three different types of flames going, all at once, to create a texture and depth. We also experimented with all kinds of gases and fuels — propane, diesel, alcohol — to find out what kinds of different looks we could get with each.”

After two weeks of experimentation, Hall and Pinney produced a film test to show to Salomon and Howard. “It was mainly to give Mikael an idea of what film stocks he might want to use and at what speeds he would have to shoot the fire sequences. It was a simple test — a fire burning in the foreground, smoke in the background and someone running through — but when they edited it all together with music and everything, it was clear that we were on to something exciting.”

By the time principal photography began, Hall and his crew had devised a variety of techniques to produce the Backdraft fires. “If it burned, we used it,” Hall asserted. “One technique we used was to pump alcohol through accumulators — which are pressure tanks — over a propane flame. We couldn’t use air to pressurize the tank because air burns and we’d have had an explosive. So we had to get all the oxygen out and pressurize it with CO₂ or nitrogen — something that wouldn’t burn. Then we would force that through atomizing heads. By spraying alcohol over a flame, we were able to add a real texture and richness to the fire. Sometimes we would dye the alcohol a little red or green or blue. We also used propane in both liquid and vapor states. Sometimes we would spray diesel over propane. To get a rich, red burning flame we would use Mapp gas — which is a combination of propane and acetylene — although we couldn’t use that on interiors because the fumes were very toxic.”

In addition to propane, alcohol and diesel, Hall also used contact cement — a highly flammable adhesive — to create spot fires. “Contact cement is very volatile and we could use it to light fires on things here and there. We learned a lot about contact cement — which brand burned which way and the different kinds of ash that each would leave.” After much experimentation, the effects team found that a cement used for making shoes produced the most satisfactory results. “I’m sure the distributor thought there were fifty new shoe stores in Chicago,” Pinney commented. “We had days where we went through a hundred gallons of this stuff.”

To add texture to the fire sequences, Hall's team created an 'ashomatic' from a device used to clear air from mine shafts. "We bought a special cardboard in thin strips that we would burn in vats to create the ash. Then one guy would shovel the hot ashes into the end of this machine and blow it all over the set. The actors really hated it because little sparks would fall on them and it was irritating. Scott Glenn hated it the most — he'd start bitching as soon as he saw us coming with it — so at the end of the show, we built a cardboard ashomatic and laced it with explosives and let Scott push the button to destroy it."

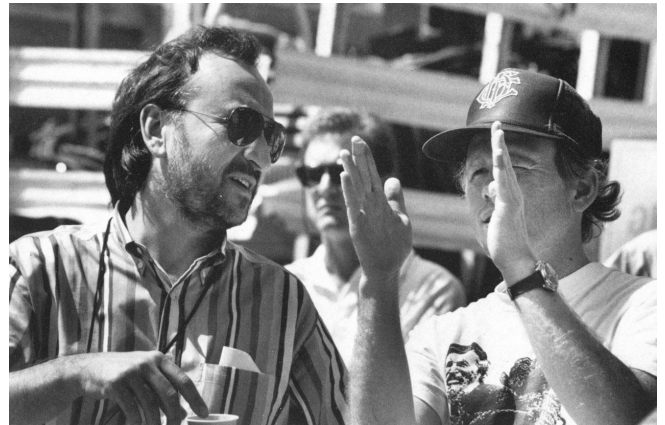
The ultimate look of the fires depended largely on the manner in which they were photographed. "You see a lot of movies with fires where the fire is totally white" said Salomon, "and that's because it's overexposed. I don't think that white fire looks realistic. It's very tempting to let the fire be your light source — but it's like shooting into your own lights and I opted not to do that. I went instead with daylight balance lighting and stepped it way up so that the fire would retain its shape and color."

To protect the camera in the intense heat of the fires, Claremont Camera built special fire boxes to Salomon's specifications. "Danny Claremont suggested that he build two housings — one lightweight and one heavier that could really take a beating. He built one that was water cooled and one that was not. We ended up using the non-water cooled one the most, because usually a shot wouldn't run more than a minute or two and it turned out that the housing alone protected the camera well for that period of time. So we used that for remote cameras. When we had to hand-hold the camera, we would wrap it in Refrasil, which is a kind of fiberglass fabric. Sometimes we wouldn't even have to do that because the camera would still be fine even after the operator couldn't stand the heat anymore."

An ongoing problem for both the special effects team and the cinematographer was regulating the amount of smoke in each shot. Though, realistically, fires of the magnitude depicted in the film would create thick, billowing smoke, the smoke levels had to be controlled so that the



Firefighting brothers Brian and Stephen McCaffrey (William Baldwin and Kurt Russell) batter down an apartment door to rescue a young boy trapped inside a blazing tenement in *Backdraft*. Spectacular fires — orchestrated live on set by special effects supervisor Allen Hall — highlight the tale of sibling rivalry set against a tapestry of arson murders and big city corruption.



Looking to explore the theme of contemporary heroism, director Ron Howard found himself drawn to the Gregory Widen screenplay which drew upon the writer's own firefighting experiences in its depiction of a high-risk profession often taken for granted. Planning a setup with cinematographer Mikael Salomon, Howard lines up a shot during principal photography on the streets of Chicago.

action would not be totally obscured. “In some cases,” said Salomon, “Allen’s team would use a lot of diesel, which created a thick black smoke that would billow up so we couldn’t see anything. That smoke looked really good, but it just wasn’t practical. We would have to evacuate the room every time and shut down for half an hour to vent the smoke out. Finally they went with propane and alcohol and the contact cement — which created very little smoke — and then we added our own smoke, which was much more controllable. We used cracked oil for an overall ambient smoke. Then for shots that required a specific look we would pump in black and gray smoke. Black smoke is very toxic — we’d take one breath of it and we couldn’t breathe again, literally, until we got away from it. So on a lot of the shots, the camera operator and I used scuba gear.”

In addition to standard fires, Backdraft called for an incarnation of the fire — a malevolent ‘brain fire’ manifestation — seen by Brian alone and perceived by Howard as a central character of the film. Hall had done numerous tests during preproduction to come up with a look for the brain fire — tests which continued well into production. “Ron would say, ‘I don’t really know what I want — I just want something different.’ So we’d experiment for another week and then show him what we’d come up with. One of the things we tried was to actually put a human shape into the fire. We blacked a guy out and lit him entirely on fire and photographed that. The idea was to matte that into flames so that it would look like a flame figure was emerging from the fire. We also took a glassmaker’s glove, painted it black, and then soaked it down and set it on fire and moved it towards the camera and back — as if a hand was reaching out of the flame. Both ideas produced interesting results, but Ron wanted the effect to be more subtle.”

ILM, too, tested approaches to the character fire during pre-production, including computer graphics techniques. “Scott Farrar’s idea was to personify the flame by putting a face into it,” said effects art director Paul Huston. “Film frames of fire were scanned into the computer and then I painted the faces in on the computer paint system. If we’d gone in this direction, we were going to use film footage and then animate the character fire frame by frame in the computer. It would have been a short sequence in each case — probably only ten to twenty frames — so hand-animating would not have been too labor intensive. A drawback was that there was a certain amount of flickering with that technique because it’s impossible to put the same paint stroke in exactly the same place with each frame. But I’d done a lot of flame retouching in *Die Hard 2* and the flickering was not too objectionable because the flames themselves flicker and jump around. It would have been a viable approach, I think.” Low-tech approaches were also explored at ILM. A head was sculpted out of plaster and wrapped with kerosene-soaked burlap and set on fire. “We shot that at different angles and speeds with wind blowing on it. Then we matted that image into fire footage, trying to blend the face in with the flames in a subtle way. It looked very interesting, but it was really too fantasy-like and obvious for such a realistic film.”

The character fire had still not been licked by the time principal photography began. Though testing continued, the final brain flame look was actually stumbled upon in the course of shooting one of the major fire sequences. “We needed fire rolling across a ceiling,” recalled Hall, “so we had put rubber cement in a line on the ceiling and then lit it. The effect was unlike anything else we had seen. Because the fire was at the ceiling, at the very top of an enclosed

space, it would very quickly burn out all of the existing oxygen at the top and then dip down in little waves to take in more so it could keep burning. Richard Lewis, the producer, saw it and said: 'That's it! That's the brain fire!' He talked to Ron; and once Ron approved it, we began working on ways to improve the technique so that we could control it better."

Ultimately, the brain fire was achieved by pumping propane through 'fantail' burner units rigged into a false ceiling piece. "By varying the pressure and the volume of the propane, we could shoot it way out and get big long loops of flame or bring it back down and get a very fine look. We also enhanced the effect by rigging the ceiling with copper tubes with little holes in them that would spray out alcohol. So a finger of alcohol would come out and change the structure of the flame a little bit. Other times we would use air tubes to change the shape of the brain fire and make it move in a certain way. It was like painting with flame." Though the special effects team was primarily responsible for shooting the brain flame, a majority of the shots — because of the unusual movement and character of the fire — were matted into background plates by ILM.

Backdraft was shot entirely in Chicago — at a number of exterior locations and on stage at Chicago Studio City. Once on site, Hall's primary concern was the safety of the actors and the crew. To keep them relatively comfortable in the intense heat, the actors were fitted with special vests through which ice water was pumped. They also wore Nomex suits — fire resistant suits worn by race car drivers — and had fireproof gel applied to their hairlines before each take. To relieve the effects of heavy smoke, oxygen tanks and breathing apparatuses were stationed just off-camera so that the actors could take clean breaths between takes. Safety precautions included painting arrows and installing flashing lights to mark exits so that both actors and crew members could find an escape route if something went awry. "We would have the fire department come in and look everything over," said Hall, "and if they thought we needed another exit someplace, we'd cut a hole in the wall. We never spared a penny on safety measures and we made sure we were covered ten different ways." As an added precaution, two of Hall's crew members — equipped with fire extinguishers — were assigned to each actor, ready to move in if a problem arose.

For particularly dangerous scenes, stuntmen would perform the actions in several trial runs until the actors felt comfortable enough to do them themselves. "Once they got their confidence in Allen," noted Pinney, "they were willing to do whatever he suggested for each particular shot. Kurt was really the leader — he's a ballsy guy and he was right in there. But all of them got very comfortable with it. The first time we lit something up, they all backed away; but by the end of the show, it was getting cold in Chicago, and we'd light something up and they would stand there and warm their hands by it." The extent to which the actors became involved in the production derring-do is reflected in the fact that the three principal firefighting performers — Kurt Russell, William Baldwin and Scott Glenn — all received stunt billing in the film's end credits.

Backdraft opens with a flashback to the 1971 fire that leaves Stephen and Brian without a father. Exteriors for the sequence were shot at an old condemned hotel, a wooden structure that was one of the most hazardous locations of the entire shoot. A week before the sequence was shot, Hall's crew lined the interior of the building with drywall and then covered the entire

space with sheet metal. “It was such an old building we were afraid it would really catch,” Hall recalled. “By the time we were done tinning the room, it was completely silver. We did the same thing on the roof — laying out drywall and tin to be sure we wouldn’t damage anything.” Interiors were shot separately on a stage set.



Simulating out-of-control fires was the order of the day for Allen Hall and his pyrotechnics crew. For the chemical plant blaze that climaxes the film, the effects team modified a condemned waterfront building by fabricating boxlike rooms behind each window to contain the flames. Propane gas lines were fed into individual window areas and giant fans inside insured that the resulting flames blew outward.

The sequence features the first glimpse of the brain fire, as well as the first backdraft effect which, in the narrative of the story, causes an explosion at the rooftop and the death of the senior McCraffrey. A backdraft is an actual phenomenon that occurs in a closed space after all the available oxygen has been burned. In the absence of oxygen, the space is void of open flame, yet it is filled with super-heated gases. As soon as oxygen is introduced into the environment, those gases burst into flame, blowing out at great force in the direction of the oxygen source. "We talked to firemen that had been blown across highways and down stairwells from these things," noted Hall. "They really do happen."

Eight large fantails were set up to produce the flames leaping up from the roof of the building. "We had found in doing our tests that Ron preferred the wide flame we got from the fantails to the flames we got using a slotted pipe." said Pinney. "Each one of the fantails on the roof had a diesel spray head over the top of it. So we could control the smoke level — if we wanted a lot of smoke, we could crank up the diesel; if we didn't want too much, we would turn it down. Our crew members on the roof that day couldn't see anything because the wind was blowing the smoke back over them. And it was so cold up there that the propane bottles were freezing up, so we had to heat them." An additional four fantails were stationed inside the building to produce flame and smoke in the windows.

For a shot of young Brian's POV as flames start licking out from above the window where his father is fighting the blaze, small holes were drilled into the masonry of the facade wall fitted to the building. "We implanted a ring of propane above that window and poked holes in the wall that we could pump alcohol through. On cue, we could crank that up and it would start to burn — flames would shoot out as the alcohol came through, and then recede and shoot back out



Actor William Baldwin runs a gauntlet of fire in one of many scenes that called for the principal actors to work in close proximity to major fires.



His face smeared with protective fire retardant gel, stuntman John Casino — doubling for Kurt Russell — is struck by a fireball blast during the assault on the burning tenement.

again.” Subsequent shots of Kurt Russell — playing his primary character’s father — and Scott Glenn inside the smoke-filled room were filmed on a set constructed on the Chicago Studio soundstage. As the ceiling of the room collapses, a backdraft is formed and a pullback shot reveals the explosion on the roof of the building. Several thirty-pound black powder naphthalene bombs were rigged to create the blast, with air mortars positioned strategically on the roof to kick out debris.

In addition to the footage shot on location and on the stage set, the 1971 sequence featured fire elements shot at ILM, including shots of the brain fire crawling along the ladder and the wall of the building and additional flames coming out of the windows. The flames were shot on a black miniature section of the building so that they could be lined up correctly with the fire in the live-action plate. “A lot of cheated perspectives were necessary for that sequence,” said Scott Farrar. “We would put a frame in, look at it through the camera, then adjust the size and the heights above the camera to make it fit. We had to play with it quite a bit.”

The story moves from flashback to the present, introducing Brian who is now an adult just recently graduated from the fire-fighting academy. Shortly after being drafted into his brother’s company, a series of backdraft fires thrusts Brian into the hazardous world of firefighting. The first is set at the home of a city official. As he opens his front door, the man is hit with the full force of a backdraft explosion which demolishes the house and sends his charred body flying through the windshield of his parked car. Locked-off cameras were used to shoot the actor approaching the door. Then, just as he opened it, the cameras were cut and the actor was replaced with a dummy. The location set — an abandoned house built in the 1890s — was fitted with balsa wood doors laced with primer cord. “There was ten to fifteen feet of fifty-grade primer cord in the door,” explained Hall. “Then, behind the door, we had a ‘Big Bertha’ — a pressure tank that has a quick-action release valve. With the push of a button, all the propane came out instantaneously.”

“We had eighty-five pounds of pressure with ninety-five gallons of propane,” Pinney elaborated. “We also had naphthalene bombs at each window and we had glass and breakaway balsa wood frames in all the windows. The windows were also laced with primer cord. Basically, there were three ignition points — the one immediately at the door, because that is where the air would have sucked in first, then the windows and then the upper stories — one right after the other. It happened so fast on film that it looks like it all went at once, but there was actually a progression. That was one of the first big things we did on the show. After the explosion, one of the grips said, ‘Oh, this is going to be a big movie.’ It was a huge fireball — we were sixty feet away from it and we could feel it. By the time we were through, we all had ‘Backdraft’ haircuts — singed in the front.”

The second major fire was set in a garment factory. Dubbed the ‘mannequin fire’ because of Brian’s panicked rescue of a mannequin during the scene, it took two full months to complete. The conflagration was shot in the relative safety of an abandoned concrete warehouse. Because the script called for a floor to collapse in the course of the action, the primary location was on the third floor of the warehouse. Just rigging the upper story of the cavernous building was a major feat. “We were carrying hundred-pound propane tanks up three and four stories,” noted Hall, “so just the physical labor involved was awesome. We used cherry pickers to haul some of

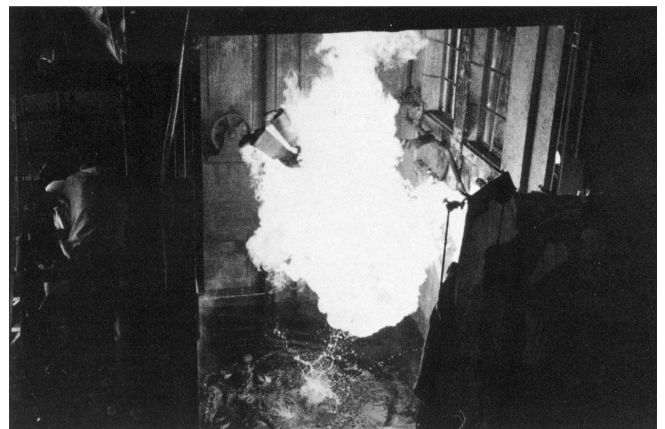
the stuff up there — we'd load the baskets and swing them out as close to the building as we could get, with people leaning out from the windows to grab these big tanks. We had forty tanks for this fire and almost filled another building just with supplies." Catastrophe was very narrowly avoided on one occasion when the basket of the cherry picker carrying tanks and a couple of crew members forty feet in the air started to tip because of the heavy weight load. Fortunately, the operator was able to swing the basket toward a window at the last moment, spilling the equipment and the crew members rudely, but safely, inside the building.

Hall had specifically requested that wools and cottons be used in dressing the garment factory set. When he arrived for the first day of shooting, however, he found bolts and bolts of polyester. "I guess wools and cottons had been too expensive in somebody's mind. I knew the polyester was going to be a problem — it's extremely flammable and it gives off toxic fumes when it burns — but we tried it anyway. When we lit it up, black smoke immediately started working its way down from the ceiling. The flames were on the ceiling, fifty or sixty feet out in all directions. Everybody was grabbing somebody and pulling them out." The Chicago Fire Department — on hand throughout the production — quickly extinguished the flames and the polyester bolts were replaced with cotton and wool which the effects people could douse with water and contact cement and still create a controllable blaze.

As scripted, the sequence begins with the firefighting team ascending a stairwell to the third floor of the factory where the worst of the blaze is centered. An exterior shot tilts up from a fireman at the pumper truck below to the burning building. A massive explosion erupts, shooting flames out the windows of the second floor and up through the windows of the third floor. The effect was produced in miniature by ILM. "The scene was a tilt-up from the fireman by the truck right at the moment the building behind him explodes," said Farrar. "I decided to shoot a move with the foreground fireman and then add a move with the miniature building. So when the fireman said his line of dialogue, we did a tilt-up — actually doing the camera move there on location, even though



In a garment factory blaze, Stephen McCaffrey sprints ahead of an explosive fireball that threatens to engulf him. A set amount of pressurized propane, ignited electrically, was found to produce a fireball that was sufficiently repeatable in size and force that Kurt Russell was able to play the scene himself. The blast — which came within inches of the actor — was ultimately a cutting room casualty, though it did appear in the trailer.



In the chemical plant, Stephen leaps through a wall of flame — a stunt performed by John Casino — to rescue his brother who has fallen into an elevator shaft that is rapidly filling with water. Suspended from a crane over a swimming pool, the elevator shaft set was lowered gradually during the scene to simulate the rising water level.

the building wasn't there. We did it a few times just to get the speed and the feeling right. Then we brought that piece of film back and photographed the miniature with the camera locked off. Finally, we created a match-move on the Mechanical Concepts printer so the photographed miniature 'traveled' with the live-action move."

The dress factory model was built in quarter-scale by a twelve-member crew working under the supervision of Jeffrey Olson. "Originally the shot was going to be a much tighter view on the corner of the building," said Olson, "but then it was expanded — which made for a bigger model. Ultimately we had three stories showing and the overall building was about ten feet tall and twenty feet wide. Our biggest challenge was to make the industrial windows look realistic. On the model, the windows were about four feet by two and a half feet, and each one contained eighty individual panes of glass. We ordered very thin glass — 20/1000s-of-an-inch thick — from a place in New Hampshire and then made all the aluminum window mullions. I made up a master mold and we cast forty-five sets of windows that had posable louvers. Then we broke out twenty percent of the windows — cracked them to give the building an aged look." The face of the building was made of cast hydrocal plaster brick. "All the brickwork was three-dimensional so there would be realistic shadows and highlights. We screened plaster through a brass brick template and from that we made a mold. Then we cast up multiples which were bolted onto a steel framework that held the whole shape of the building. We were able then to take out any of the charred pieces and replace them in a turnaround time of about a day. The brickwork was colored a basic red and then we washed in all the grout lines and the cement."

To meet the requirements of the shot, the model was rigged so that the lower windows would explode and emit fire while the upper windows would implode and suck the flames inside. "To get the glass to break and the fire to emerge at the same time was a real trial-and-error process," noted Olson. "We ended up shooting it three times with three new sets of windows. The heat of the fire managed to destroy all the brickwork each time we did it, so we also had to replace that."

"Behind that model was an incredibly complicated morass of plumbing and piping and wiring and exploding devices," Farrar elaborated. "All of our action had to happen in a very few seconds. So, mechanically and physically, it was tremendously difficult to get the timing right. Our pyro people had propane and kerosene plumbing in each window — five windows total on the lower story and another five windows on the upper story. There were detonators or primer cord on the windows to blast them, and there were wiring harnesses up above so that on a cue the windows could be mechanically yanked in to make them implode. There were also giant venturis for each window. A venturi works something like a jet engine — it creates a huge suction — and that's what we used to pull the air in so that the flames would actually roll into the upper windows."

After three attempts, the ILM crew got a satisfactory take of the fire and explosion. The miniature fire footage was then modified in the optical department. "We took the miniature, which they had shot static, and added a tilt-up from the fireman to the building," stated optical photography supervisor Brad Kuehn. "Scott wasn't satisfied with the tilt in the live-action footage, so we had to match it and then modify it a bit, slowing it down as it went to the building. We also incorporated a little riding motion to make it bounce a bit with all the

explosions. We added some fire and smoke to the shot, as well, to augment what they had gotten on stage. We used a combination of soft splits to combine the two buildings together, and then matted fire over fire.”

The subsequent live-action interiors were filmed with nine cameras — many of them remotely operated. “The main cameras we used were Arris that were hung on bungee cords,” related Salomon. “Then, when the explosions went off, we jiggled the cameras to give the scene an extra ‘earthquaking’ effect. We built rigs for them so that we could shake them on wires from about a hundred feet away.”

One shot shows a wall of flames blasting over the firemen’s backs as they hit the floor. Hall’s team executed the gag with three gas mortars stationed inside the building. “The actors were hunkered down and we aimed the mortars at a slight upward angle” said Hall. “We blew out two or three windows with the propane mortar. Since gas expands once it’s in a limited space, we had to test it to make sure that we wouldn’t completely engulf the room with flame. We used just enough explosives to stop short of filling up the room. The flame was aimed upward — and because it was hot, it stayed at the top. As long as the actors remained hunched down to below two feet, they were okay.” Eighteen black powder mortars shooting debris and naphthalene were positioned outside the windows to create the illusion of explosions going off all around the firefighting team. In the following shot, the firemen hit the blaze with their water hoses, creating a giant cloud of steam. “We couldn’t use real steam because it would have been too hot, so we cheated it by pumping liquid nitrogen through copper tubing and aiming it toward the actors.”

The explosion and resulting fire cause the ceiling of the second story to collapse. “The first thing we had to do was cut a hole in the third-story floor — which was eighteen-inch-thick concrete,” said Joe Montenegro. “We had to bring in some contractors and big equipment to do that. Then some Chicago carpenters laid in a wood floor over the hole and our crew hinged it so that it would open in two pieces, steel-framing it underneath so that it would swing down like a couple of big doors. We mounted hydraulic cylinders so that we could swing them up and down for easy retakes. The cylinders were drilled into the actual concrete, eighteen feet from the second story up to the floor of the third story. It all had to be fireproofed because when it opened up there was a big fire going down below — and all of that fire below wanted to go up where the hydraulics were. Hydraulics are full of oil, which burns very easily, so we wrapped them in a fireproof ceramic cloth to protect them.”

Montenegro operated the hydraulics from the second floor, at a control unit twenty-five feet from the rigged floor piece. A video monitor allowed him to watch the action on the third floor and thus time the effect accurately. “Everything had to be coordinated really well, because if the upstairs had been lit before we were ready downstairs, we could have had preignition flames coming down while we were still in the middle of pouring our fuels. That actually happened one time, but the effects man had an escape route so he was able to get out in time.”

The mannequin fire sequence featured the brain fire crawling along the ceiling and, in a later shot, on the ground. For the ceiling shot, a twelve-by-eight-foot false ceiling piece was constructed and mounted onto the actual ceiling of the building. “We put the fire source on one

end of the piece,” explained Gary Karas, “and then tilted it just a little bit so the brain fire would climb and roll. The ceiling piece had two or three fantails in it, too, as well as little igniters and tubes of alcohol to enhance the overall effect.”

Though the brain flame effect was a more or less natural phenomenon on the ceiling, to get the same rolling effect on the ground — or a vertical climbing effect, which was also called for in the scene — required the efforts of both Hall’s team and ILM. “Because of the nature of the brain flame,” explained Pinney, “and the physics of the way fire behaves, the flame could not really move on the floor or crawl up something in that manner naturally. So we had to build a room-sized section of the set upside-down on our burn stage and shoot the brain flame there to make it look as though the fire was crawling on the ground.” The vertical traveling movement of the brain flame was shot by ILM through a piece of glass. “The flame was actually on a horizontal piece, and then they reflected that in a pane of neutral density glass so that you could still see through it but it also reflected — like a heads-up display in your car. They would shoot through that, and by changing the angle of the glass it would appear that the flame was moving vertically.”

A shot from the sequence that was ultimately used only in the trailer showed Kurt Russell running from a huge fireball. “It was a spectacular shot,” said Hall, “one of the best shots we did in the whole show. The fireball was about forty feet across and twelve feet high — it filled the whole factory — and we rigged it so that it would stop at a particular point. We could predict where the fireball would stop by using the same amount of pressure every time. We would give Kurt a start mark and once he started running, Clay would hit the button. We had about eighty pounds of propane under pressure, released by an electrical solenoid dump valve. When you electrify the valve by pushing the button, it opens in a four-inch diameter all at once — and because it is under pressure, it just blows everything out. It’s like an explosion, but it’s very controllable. Wherever you set it, it will repeat the same blast effect time after time. Once Clay hit that button, though, Kurt was on his own. If he had stopped for some reason, the fireball would have engulfed him. He had to keep running once he started.”

From the mannequin fire — the first major sequence shot for the film — the special effects crew went on to three smaller sequences. One was set inside a burning tenement building where



The garment factory fire was staged in an abandoned warehouse. Most of the action transpired on the third floor where a section of the existing concrete floor was cut away and replaced with a hinged wooden floor activated by hydraulic cylinders. At a crucial moment during the conflagration, the floor collapses and one of the firemen is nearly lost in the inferno raging below.



Stephen rescues a small boy; the second took place inside a theater; and the third was set in a high-rise office building where a rookie fireman is killed.

The scene is set in a high-rise office building where a rookie fireman is killed. Brian McCaffrey had properties that allowed it to be produced only on ceilings or on the undersides of surfaces. Consequently, for a scene where the filmmakers wanted it to creep across the tenement floor, an inverted set was constructed. Firemen extinguish the flames between takes.

The tenement fire was shot both on location and on the stage. For the exteriors, a location building was rigged simply with a few fantails to put flame in the windows with smoke coming out of the top floor. On the stage, a hot bulging door was simulated by having Clay Pinney push gently on a rubber door that had been mounted in the set. As the door is kicked open, a ball of flame rushes out, knocking Brian down and putting him, once again, face to face with the brain flame that crawls ominously around the empty doorway. The character fire was actually ignited over William Baldwin's head on a ceiling piece and then projected onto the doorway by way of a fifty-fifty mirror placed in front of the camera. As Brian stares into the eye of his old nemesis, it appears as though 'fingers' of flame reach out to grab him. "We were able to achieve that with great accuracy just by making sure that the pressure settings on the alcohol accumulators were the same every time," explained Pinney. "It looked absolutely awesome on the set, but because of the pale intensity of the flame, it did not really read as well on film." Also shot on the set was Stephen's rescue of the child. The special effects crew was understandably nervous about subjecting a three-year-old to the hazards of smoke and fire and did everything possible to protect him. "We made sure there was very little fire on the side where Kurt was carrying the baby," said Hall. "Also, Kurt was very aware of protecting him — he had his coat up around him as much as possible."

In the theater sequence that follows, the firefighters find evidence of yet another backdraft murder. All of the effects shots were achieved by the second unit under the supervision of Tom Ryba. "There was actually no explosion for that backdraft effect," noted Pinney. "We blew smoke under a door and sucked it back out to show that a backdraft was imminent. Then the door is opened and papers get sucked out of the victim's hand as the camera rushes to his face and whites out. We had big fans to create the suction and a piece of tungsten wire attached to jerk the papers away. The papers burst into flame, which Tom did by putting flash paper in with the stack of papers. We brought some flame up to light the actor's face; and then the white-out was just an optical effect."

Interiors for the sequence were shot inside an actual theater that was in the process of being renovated. "We broke a lot of seats loose, made a big pile of them and then threw smoke and debris down in the middle of it," stated Pinney. "One thing we did differently for the theater fire was to use bee smoke — which is a pine resin used for putting bees to sleep. It was brought up to a temperature where it turned to vapor and it striated very nicely. We worked a lot with Mikael to come up with different things so that every fire wouldn't look exactly the same. We also blew powdered charcoal through some pipes and over a flame to create little sparks floating up. We did a lot of that to simulate embers throughout the interior."

All of the fire scenes in the high-rise were shot on stage. At a critical point, the rookie fireman kicks open a door which creates a backdraft explosion that blows him back through an expanse

of glass doors. A ramp was set up so that the camera could dolly up to actor Jason Gedrick's face quickly — as if representing the point of view of the fire. In the following shot, stuntman Mike Johnson jumped off the ramp and flipped backwards into the doors. "We had glass crackers to make sure the glass would break," said Hall, "and we put contact cement on the guy and lit him with a propane mortar. Kurt Russell dove on top of him while he was on fire — and there were flames licking up around his face as he was struggling to get the fire out." A mechanical head and torso puppet — with wax features to suggest the rookie's face melting away — was used for shots of the firefighter burning on the ground. "Mike Johnson put his arm through the floor, right next to the puppet, so we would have a real arm flailing there," Pinney related. "Lance Anderson — who built the puppet — operated the rolling of the head with cables."



Their lives in the balance, Stephen McCaffrey and fire captain John Adcox dangle from a collapsing catwalk inside the blazing chemical plant. Though their height off the ground was cheated, actors Kurt Russell and Scott Glenn played much of the potentially dangerous scene themselves — including segments calling for Glenn's uniform to be smeared with flammable contact cement and set on fire.

Backdraft's grand finale takes place at a chemical plant where a massive fire has broken out. On the way to the blaze, one of the fire trucks swerves to avoid a vehicle and overturns — a stunt achieved in full-scale by the special effects team. "To overcome the truck's natural stability," Hall explained, "we superin-flated the inside tires and let all of the air out of the outside tires. We also filled the ladder in front with steel and elevated it eighteen inches — which made the vehicle very top-heavy. In the back, we had a track with about thirty-five hundred pounds of lead on it. As the truck went around the corner, the lead slid to one side, which was all it took to flip it over."

The chemical plant fire is first revealed in a series of exterior shots filmed at a condemned building on the Chicago waterfront. To contain the live-action conflagration, the special effects team built a small, boxlike room behind each window. "We had a big fan blowing in each room to make sure that our flames would move out of the windows even if the wind was blowing against us," explained Hall. "Every time we did an exterior fire we had to worry about the wind. If the wind was blowing against that fire, it would all come inside the building, which could be really dangerous. So we had big fans and pressurized air inside these little rooms to make sure that the fires would move out and not in." Crew members controlling the propane gas lines were stationed

approximately seventy-five feet behind the

windows. "Even though they were positioned pretty far back, they were still on the same floor with the fire, so I was a little nervous about what would happen when we brought the flames up. When we turned it on the first time, the heat was so intense that it blew out all the windows and melted the glass in the frames. So it was raining down real glass and everybody was diving for cover. The fire got so hot that there were big chunks of concrete popping out and falling five stories. Concrete contains moisture, and when you heat it up it creates steam and it starts to expand and break. So we caused some superficial damage to the building, but fortunately that didn't matter because it was being torn down anyway."

After the establishing shots, the action moves to the top of the building where the firefighters must suddenly run for their lives as the rooftop caves in. The collapsing roof shots were achieved both on a set and in miniature. The live-action segments were filmed on a large



Although most of the film's fire effects were accomplished practically, Industrial Light and Magic contributed a handful of visual effects. Among them was a street-level shot that panned off a fireman standing by his truck and up to the garment factory just as the second-story windows blow out and spread the hungry flames to the third floor.



Another was a view of the chemical plant rooftop collapsing as firefighters run for their lives.

rooftop constructed on scaffolding. Joe Montenegro rigged the roof to collapse with a hinged mechanism similar to the one he had rigged for the collapsing floor in the dress factory. “We built a kind of trapdoor with huge steel frames,” said Montenegro. “It was all hinged on hydraulic cylinders and everything was fireproofed. Then we built rooms down below that were lined with tin. These rooms were basically giant fireboxes below the scaffolding, and that is where we produced the flames using diesels and alcohol and propane. We would bring those flames up just as the roof opened up — if we had had the flames cooking beforehand they would have destroyed the rooftop set. So that all had to be timed and coordinated perfectly.”

Portions of the collapsing roof were mobilized by a long set of conveyor rollers. “As the rollers moved, sections of the roof would drop,” Hall explained. “It was very simple. We also had a hand rig connected to the conveyor belt for stuntman Johnny Hock to hold onto. Since it was a low-angle shot of his feet, the rig never showed. Basically, it was a cable going to the front of the conveyor. When the conveyor pulled out, Johnny went with the cable and was always six inches in front of where the boards were falling. As long as he held onto that cable he would always be six inches ahead of the collapsing pieces. So there was no guesswork at all — which was a good thing. If he had fallen into the hole, he would have dropped fifteen feet into real flames.”

A wide-angle aerial shot reveals the scope of the fire and the tiny figures of Stephen and Brian running in opposite directions on the rooftop. The complex shot proved to be ILM’s biggest challenge of the show. “In the beginning we got a drawing of the view they wanted,” said Paul Huston. “We also got a rooftop design from Albert Brenner, the production designer. I redesigned the rooftop a bit, simplifying it for our purposes so that the action would be more visible. Then I did a series of drawings to show the progression of the destruction.”

Several mockup models were built to test the scale at which the rooftop shots would be most convincing. Because scale is problematic when shooting fire with miniatures, the model was ultimately fabricated at quarter-scale. The forty-foot-long replica — depicting the rooftop and the area surrounding the chemical plant — just barely fit inside ILM’s main stage. “The model was about eight or nine feet tall,” said Farrar, “and because we had to get an aerial view, our camera platform was about thirty feet up in the air. We had to build the miniature up off the floor to allow for the roof to cave in and drop. We also had to allow space around the outside for adjacent building miniatures. The completed model had the entire top of the building, as well as the left rear and right rear sides. The foreground area of the street was a matte painting done by Mark Sullivan.”

The model shop crew spent almost a month building all of the components for the rooftop miniature. “It had quarter-scale skylights and smokestacks and all kinds of roof paraphernalia that would fall and tip into the opening cavern as Brian ran across,” said Jeff Olson. “We built multiples of all the skylights with real glass inside of them. They were cabled to the floor so that as the floor collapsed they would be pulled down and fall into the opening. The smoke towers and cupulas on the top were made out of a zero-temper aluminum which can be bent easily. They were finished with a faux galvanized look and they were also pulled by cables. The entire floor was held together like a jigsaw puzzle suspended on poles. Then the center of the roof was

patched together with roofing paper which held it until the props were kicked out from underneath.”

To make the explosions appear full-scale, the model was shot undercranked. “I was limited,” said Farrar, “because most of the shots involved not only flame, but pyrotechnics and mechanicals as well. You can get away with flames not being slowed down a lot — but not an explosion. And we had an intermingling of the two in these shots. So we had to reach a compromise, which ended up being about seventy-two frames per second. That looked the best — but it caused a huge problem for our pyrotechnics people because it meant that everything had to happen very quickly — a six- or seven-second shot had multiple events that had to happen in real time in less than two seconds. It was very nerve wracking.”

A computerized control board allowed the crew to set off the miniature explosions and actions with precision. “Everything was pulled down into the hole as the fire built and exploded above it in a timed sequence. The windows in the model were detonated by small charges, but just the flames bursting up were enough to crack them and almost enough to blow them out. We created the flames with misted kerosene and propane that was regulated and turned up just a bit when the windows exploded in sequence with charges and rods pushing them out. The upper windows were cabled to an air cylinder in the back; and at the right moment they would be pulled in, allowing the flame to come in at the same time the glass was breaking. Everything was sequenced on a control box so we could do it in order.” The collapsing rooftop miniature was rigged and shot three separate times. Each retake required about a day and a half to refurbish and redress the set.

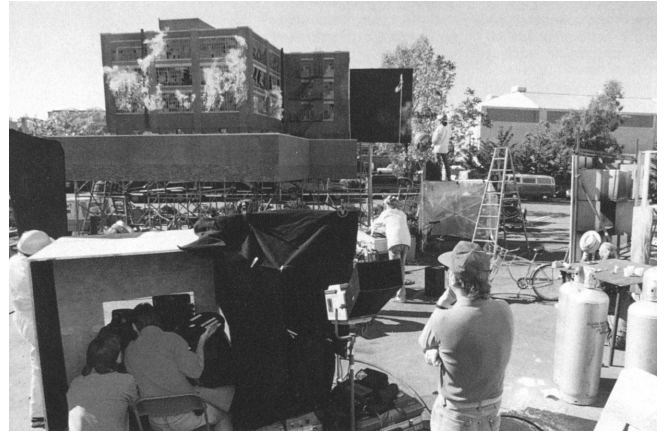
The next step was to photograph the running figures that would be matted into the shot. Because of the difficulties of matting fire, it had been decided very early that the rooftop shot would be composited digitally. “We had done a test right at the time we were first discussing this movie for a process called difference matting,” noted Farrar. “Dennis Muren and I did it together and it was a very exciting, innovative thing. Difference matting meant that we could photograph any object against a background or a color, and as long as there was a difference of a couple of stops of light — a difference in brightness — then we could pull a matte and we wouldn’t have to photograph things against bluescreen. What that meant for this movie was that I could photograph people from an actual height representing our distance looking down on this building rooftop, photograph them against concrete and still be able to get a good matte — and the only lighting we would have to have was the sun.”

Farrar found a suitable location to shoot the running figures at Hamilton Air Force Base, just north of the ILM facility in San Rafael. “It had a concrete runway and, by adding six feet of scaffolding to the control tower, we were able to get exactly the height we needed. We knew that the running distance, in real scale, would be about seventy feet. And we had calculated that we needed to shoot from a height of about sixty-eight feet. Once we found the right spot, we hired a couple of guys to do the runs. We photographed them individually and shot them at all different speeds so that we could composite them in rough form and pick the take we liked best. We set up very early one morning and got the shot in one day.”

Once all the elements were photographed, each was scanned into the computer and turned into digital information. “Digital compositing was absolutely wonderful because we could put these guys into the shot in a completely believable manner. There are no giveaways in the shot. Even if you look at it many times, there is no way to tell that there is something fishy going on. The people were shot at the right height and the right distance and there weren’t any cheated angles or anything like that. And they are real people, rather than puppets, and the shadows are correct.” In addition to the rooftop miniature and the shot of the running men, fire and smoke elements were composited into the shot. “They all had to be photographed separately to insure proper exposures.”

Before being composited digitally, the various elements first had to go through a traditional optical process. “We had to have a helicopter-type move over the whole thing. So John Alexander, in optical, came up with a move that everybody liked — it was kind of a bounce, a reaction to the explosions going on. Then he had to photograph all the elements on an interpositive and reproduce the move on each one so that everything would be in sync. Each separate element could then be scanned into the computer with the move already built in. All digital had to do was put the puzzle pieces together. We’d look at everything in stages as it was coming together to check for colors and shapes and ‘mattiness.’ Then we saw a rough test. The difference with digital is that you don’t see anything for a long time, and then all of a sudden it comes out and it’s pretty much done.”

Rotomattes — also executed digitally — were necessary for instances where the running figures or their shadows were obscured as they ran behind an object on the rooftop. “The figures were very tiny in the shot,” recalled digital effects supervisor Stuart Robertson. “An arm was only about three pixels wide. In traditional optical, the edge artifact we would end up with on something like that would actually outweigh the figure itself. So being able to get down to where there was virtually no edge artifact — as you can in digital — made it possible for us to put these people into the shot in a very natural sort of



The garment factory — ten feet tall and twenty feet wide — was fashioned from a basic wooden framework and then covered with a cast plaster facing designed to simulate brick. Its twenty-one industrial-style windows required more than sixteen hundred panes of paper-thin glass — per take. Pyrotechnic charges were positioned to blow out the second-story windows while Venturis mounted behind the third-story windows drew the resulting flames inward.



An even larger miniature was built to represent the chemical plant rooftop. The quarter-scale model — forty feet long — was erected nine feet off the floor to allow sufficient room for the roof to cave in. Miniature pyrotechnic charges were triggered from a computerized control board and shot at high-speed.

way. When we were doing one of the characters running behind one of the cupulas, we put him into the scene on top of the cupula and then went back in and erased whatever part of him should have been obscured. Because we were doing it within the scene that was the actual composite, we could be very accurate about it.”

A great deal of contrast and color manipulation was required to fit the running characters into the scene. “Our digital artist, Tom Smith, spent a long time with Brad Kuehn going over the color picks and the various matting questions. Tom worked essentially as a Harry artist works in video, sitting down at the screen, putting the pieces together, doing the cutting work, the rotomattes and the color corrections. Another tool that we have in digital is that we can select a particular area of a background scene and darken or lighten it, add contrast and decontrast. And we could use the shadows that the people cast on the concrete as that selection tool so we could put that in and literally darken the area of the background, almost as if we matted it in all to itself at a different color and brightness level. Doing that helps preserve a lot of the detail in the shadow.” When the completed shot was sent to Ron Howard for approval, the director thought that the digital composite looked a little too good. “Ron felt it was too sharp and crisp,” explained Kuehn, “so after digital finished the shot, they spit it back out onto an eight-perf negative and we then degraded it a bit so that it would cut in better with the movie.”

Brian’s sprint across the collapsing rooftop ends with his diving through a window — a stunt that was filmed on stage — and falling through an elevator shaft into a pool of water. Allen Hall’s team constructed the elevator shaft over an exterior swimming pool at a local high school. “The pool was sixteen feet deep and we had to keep it heated and monitor it all the time so that the water wouldn’t freeze. We built the elevator shaft on a crane over one corner of the pool — so the crane could pick the shaft up and put it down. To create the effect of water rising — as it supposedly does in the narrative — all we had to do was lower the shaft.” A gas jet opened by falling debris causes fire to start rolling down the shaft toward Brian. For a shot of the fire skimming across the water as the fireman dives below, flames from a half-inch pipe were directed across the pool. “When Billy Baldwin’s face went underwater,” said Pinney, “I’d lick the flame over top. Then when he put his hand up, I would pull the flame back so that he could come up for air. He’d grab a big breath and go back under, and I’d bring up flame again.”

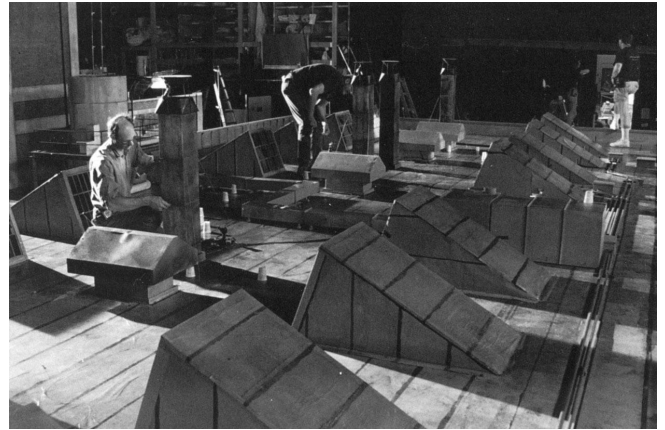
Inside the chemical plant, massive explosions and falling debris mark the escalation of the fire in a wide-angle shot that encompasses the vast interior. The chaos was created with as many as twelve fantails stationed near the top of the room, several hundred naphthalene and black powder bombs and sparks fired electrically on pyrotechnic circuits. “For a typical shot,” said Pinney, “we would have thirteen or fourteen guys doing one or two things each. We had teams that did nothing but put down the rubber cement. Once the cement is down, the vapors build and it gets dangerous very quickly. If you let too much time lapse between gluing and rolling cameras, you can build up enough fumes to cause premature ignition. So it was a kind of precision-timed ballet with this team out there gluing everything at once.” Delayed explosions were created by tossing bags of black powder into the flames. “After a certain amount of time, those would blow. Besides the sparks and explosions being filmed, there were a lot of background sparks and flashes for the reactive lighting that Mikael wanted. So in almost every scene there was off-screen stuff going on, too.”

To add to the hellish atmosphere, large barrels were rigged and fired into the air. “The barrels were blowing up as if explosive chemicals were inside of them,” noted Hali. “Firemen told us they had actually seen fifty-five gallon drums blow up like that. We got really good with them. We mounted them on an aiming mechanism and got to where we could hit within inches of our target.” In addition, the destruction of the chemical plant was suggested by large pieces of metal debris carried in baskets mounted on cables. On cue, the cables would be cut and the baskets would dump their heavy loads into the scene.

Special effects crew member Rio McNichols braved the holocaust to add even more smoking, fiery debris to the environment. “We called him Rio Debris-o,” noted Hall, “and he was really one of the unsung heroes of this whole show. Rio was up at the top of the room wearing a breather — you absolutely couldn’t breathe the air up there without searing your lungs — and he would light big chunks of lumber and toss them down, trying not to hit the actors. At the same time, he had to dodge the barrels that were blowing up towards him.”

As the building comes down around them, Stephen and Adcox — who has been revealed as the arsonist behind the series of murders — hang precariously onto a catwalk suspended sixty feet into the air. To get the lurching movement of the failing catwalk, Joe Montenegro rigged the set piece with hydraulics and a cable pulley system. “The hydraulic cylinder was mounted to the floor, about thirty feet from the set, and compounded to the ceiling with cable that went back and forth three or four times. Then we ran it through pulleys back over the catwalk. So the catwalk was actually suspended from the cables, and at any given time we could release it down all the way or partially — whatever the shot required. We had it timed so that as an explosion would go off, we would drop the catwalk a bit. We also had cable cutters so that we could chop a cable and dump the catwalk down to the floor, which we eventually did.”

The catwalk setup was steel and weighed over eight hundred pounds. “We were controlling a section of the catwalk that was about nine feet long, and Kurt Russell and Scott Glenn were



Modelmakers add finishing touches to the chemical plant rooftop. Massive rerigging and detailing was required between each of the three separate takes. Running figures were digitally composited into the collapsing rooftop footage and supplemental fire and smoke elements were added. A subtle optical move was also incorporated to suggest that the shot was photographed from a hovering helicopter.



A full-size rooftop was constructed by the main unit. For scenes of Brian McCaffrey running for his life as the roof disintegrates behind him, the special effects team rigged portions of the set to fall away amidst flames leaping up from below. To insure safety throughout the drop-away floor sections were tied into a conveyor belt mechanism that pulled stuntman Johnny Hock forward in

actually hanging on this thing — which is why we had to overkill with the hydraulics and cable. We rigged something like three thousand pounds of cable and we had safety chains on everything.” Though not suspended as high as it appeared in the film, the catwalk was still nearly thirty feet in the air. “It was high enough to kill a person if they fell,” Hall commented. “And then, to give the impression that it was even higher, we built half-size barrels and even smaller barrels to place on the ground. So it was a forced perspective set. We also produced some smaller fires down below to make them look in scale, too — we used pints of rubber cement instead of gallons.”

advance of the rooftop collapsing right behind him.

Stunt people replaced the actors for a shot of the catwalk giving way. Then Russell and Glenn were placed in harnesses for the closeup scene between Stephen and Adcox. “Both actors were hanging there on fire — and the harnesses were very uncomfortable, so we couldn’t have them hanging there too long. Between takes we had a scissor lift for them to stand on so they wouldn’t have any weight on them. Then at the last minute we would move the scissor lift, light them up and roll until they yelled for us to stop. Someone got a little generous with the rubber cement one time and a hole was burned in Scott Glenn’s pants. Fortunately, he had a Nomex suit on underneath, so he was fine. This was one of the last things we shot, so we were very experienced by then and the actors were very brave. Though we were always cautious, it seemed a fairly routine thing to be hanging major actors thirty feet in the air over burning debris and lighting them on fire.”

With his brother’s life literally hanging in the balance, Brian finds the courage to conquer his fear in another confrontation with the brain fire. Because it had to move ominously — and quite unnaturally — over the top of a water tank, the brain fire was relegated to the ILM miniatures unit. “There was a disparity of speeds between the practical fires and the brain fire,” explained Farrar, “so the slow-moving, waterfall-like flow of the brain fire could not have been shot at the same time the explosions and other fires were happening on the set. It was a matter of look and control.”

Shapes in a variety of scales were constructed to steer the movement of the fire so that it would matte into the live-action footage correctly. “We had to create almost puzzle pieces with the fire as it meandered around the water tank,” said Farrar. “We tried to shoot it as large as possible, but to get all the different sizes and angles we had to go with shapes that were somewhat smaller than quarter-scale. That shot required a lot of very difficult rotoscoping for Tom Bertino and his crew to make the flame fit behind pipes and structures and exploding drums.” To tie the shot in editorially, ILM also had to matte in a stream of water coming from a fire hose. “The scene just needed the water coming out of the hose — not the hose itself — to tie it in with the previous shot. So we shot a stream of water against black, all lit up, and matted that into the background plate.”

The final ILM shot was a different angle on the brain flame. “This time we wanted the flame to be coming up over the tank, with interactive light glistening and flame spilling out and pouring down over the top. We also took fire elements that were shot on stage and composited them onto the floor right in front of the tank.” One of the more difficult aspects of the shot was the fact that it included a fire hose whipping around, spraying water into the area that had to be

matted. "When water crosses in front of something," Kuehn related, "it's very tough to make it look right. So animation provided us with a blob articulate matte to go over the area. We took that matte and diffused it heavily and used a small portion of it so that when the water went in front of the brain flame it didn't look like a blob but rather some kind of exposure shift. It was really subtle, but it worked. We also had to roto the actor in a couple of places to put him in front of the flames. And since the brain flame had been shot static, we had to add another tilt-up to the shot."

Brian grabs the high-pressure water hose thrashing violently in the air — achieved on stage by marionetting the hose with piano wire — and douses the advancing brain fire. To create the resulting steam cloud, the physical effects team planted five naphthalene and black powder bombs which, after an initial flash, produced a cloud of white smoke. "We were shooting in the burn stage," said Pinney, "which was an old industrial building on the Chicago Studio City property. It was an all-metal structure, but it had unreinforced cement block walls. We set up our bombs — this was the first time we'd set off five at once — and because it was going to be very loud and very hot, I had a mask and earmuffs on. So I heard the bombs go off and I saw the puff of smoke, and then I checked in with Ron and Mikael. I was standing with my back to the wall and Mikael had this really funny look on his face. He said, 'Beautiful moon tonight.' I was wondering what the hell he was talking about. Then I looked back, and a sixty-foot section of the wall was gone — just gone. We were still able to use the shot because the white smoke had covered it, and this was another building that was going to be torn down anyway — but... oops."

In spite of Brian's newfound heroism, Stephen dies in *Backdraft's* blazing finale. The film ends on a somber note with a military-style funeral for the department's fallen heroes. The precise and pristine ceremony is in stark contrast to the pandemonium and hellfire that characterized most of the film's hundred and some minutes. With important support from Industrial Light and Magic, Allen Hall's special effects team had succeeded not only in realizing the most ambitious and exciting fire sequences in movie history — without a single injury of consequence — they had also created, in essence, a character out of fire. Hall was quick to affirm that ideal personnel and circumstances made that achievement possible. "We had the best cinematographer, I think, for this kind of action filming; and we had one of the best and most patient directors in the world. And the actors were superb. So it was a perfect situation. After it was over Larry DeWaay, the co-producer, said, 'Allen, I was talking to Universal Studios and they had suspected that there would be injuries and suits as a result of this movie. But we came in under budget and nobody was hurt, and they are elated.' That made me feel good."

In spite of the positive outcome, however, *Backdraft* was a grueling ordeal for most of the effects crew. "It was kind of traumatic," Hall admitted. The whole eight months had been so hot and so dirty and so dangerous. Usually in a film, the special effects crew has a few days in which they are doing something really big. They do it and then they can fall back and recover and get ready for the next thing. But in *Backdraft*, we were up nearly every day — every single shot for the last eight weeks of the show. For us, it never ended. We did our best to look cool and calm, but it was always in the back of our minds that somebody could get hurt. That was very stressful. During the shoot, we had T-shirts made up that said: 'If you can't take the heat, stay out of the set.' That pretty much said it all."

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ROCKET BLAST

article by

Mark Cotta Vaz

The comic book heroes of old once lived by the code of truth and justice. Outfitted in star-spangled costumes, they smote evil with a grin, a wisecrack — and a few super-powered haymakers. But in the 1980s, many of those same characters broke the code and crossed the line that once separated the good from the bad. Eighties heroes, many dressed in black, enforced their vigilante visions with a sneer and an assault weapon.

The Rocketeer, created in 1982 by Dave Stevens as a second-billed comic book feature, was a diamond in the rough, an old-fashioned adventure about daredevil pilots in the Los Angeles of 1938. What made the Rocketeer different from Tailspin Tommy, Scorchy Smith, Smilin' Jack, Barney Baxter and other pilot heroes that came out of the Thirties comics pages was not only the retrofitting of the high-flying heroics of old to the modern day, but the addition of that old-fashioned science fiction icon, the rocketpack. Steven's comic told the tale of racing pilot Cliff Secord who discovers a strange rocketpack stashed in his hangar. The young flyer sees the chance to use the pack for a big-money aerial act that would seal forever a love pact with Betty, his living doll girlfriend. The heat turns up when Cliff goes on the run from G-men and Nazis, all deadly intent upon capturing the rocketpack.

The Rocketeer was a cult hit with comics fans willing to wait out the often interminable lengths of time before Stevens, a perfectionist at the drawing table, could release his next installment. In the nine years since the Rocketeer first took flight, only eight separate installments have appeared, produced along the way by four different publishers. Given the ephemeral nature of the pop culture marketplace, a betting man would have drawn long odds on The Rocketeer making the leap to the big screen. But the

image



Based on the popular Dave Stevens comic book — an ode to daredevil flyers in the Los Angeles of bygone innocence just prior to World War II - The Rocketeer made its way to the silver screen in a stylish \$40 million presentation from Walt Disney Pictures. 'Peevy' Peabody (Alan Arkin) and Cliff Secord (Bill Campbell) — partners in a small flying business — examine a mysterious rocketpack prototype found stashed in their hangar.



Eager to try out the device, young Cliff recklessly dons the pack and a makeshift helmet and takes to the air to rescue a pilot friend whose plane is about to crash. Though successful in his mission, Cliff makes a less than optimal landing in a nearby pond. Director Joe Johnston discusses the scene with Campbell.

material attracted the enthusiastic support of the Gordon Company and director Joe Johnston. Walt Disney Pictures — for whom Johnston had made the runaway hit, *Honey, I Shrunk the Kids* — not only greenlighted the project but made it, at an estimated \$40 million, one of their most expensive movies ever and a major entry in the 1991 summer season.

One of the attractions of the Stevens material was its time-traveling recreation of the optimistic dynamics of the Thirties, the golden age of aviation, and the Los Angeles of blue skies, orange groves and movie stars. “I was looking for any year, prewar, as the time setting,” Stevens recalled. “I didn’t want to get too close to wartime because it got really dark at that point. Picking 1938 was just a shot in the dark. In that period, aviation was really at its zenith — prop planes, air races, daredevil stuff. There was still a lot of optimism in the architecture. The bullet-shaped, streamlined look of everything was really powerful, really bullish in appearance, kind of cocky. You look back at that period and there really hasn’t been another time in American history that was as singularly, aesthetically designed. I also wanted to place the Rocketeer firmly in a town that said ‘1930s’ — and as far as I’m concerned, Los Angeles, more than any other city, said that. The film studios were all here and that Thirties style and pomp came out of this town — the dream factory, the palm trees, the weird architecture. LA. seemed the only logical place to do it.”

As coproducer of the film adaptation of his work, Stevens retained a considerable amount of creative input even though many of his original comic book characters and situations were altered for the big screen. In the script by Danny Bilson and Paul De Meo, the vampish Betty of the comics page became sweet Jenny Blake (Jennifer Connelly), a farm girl come to Hollywood to make it in pictures. The shadowy Nazis of Steven’s tale became personified as agent saboteur Neville Sinclair (Timothy Dalton), who uses his stature as America’s ‘third most popular’ boxoffice star as cover. The creator of the rocketpack was originally intimidated, but never outright identified, as Doc Savage, the bronze-skinned giant and genius of 1930s pulp adventure magazines. In the movie, a real historic character, billionaire industrialist and visionary aviator Howard Hughes, is revealed as the inventor.

The title role went to actor Bill Campbell, his first movie appearance. Although the film is stocked with veteran character actors such as Alan Arkin — who plays Secord’s sage, if irascible, friend and mentor ‘Peevy’ Peabody — it was never intended as a star vehicle. Even with visual effects from Industrial Light and Magic — supervised by Ken Ralston — and lush period sets conceived by production designer Jim Bissell, the overriding concern was that every penny appear on the screen. Joe Johnston’s background as an Academy Award-winning effects artist on *Raiders of the Lost Ark* attested to his abilities at orchestrating effects and crafting a Thirties period adventure. Despite his visual effects background, however, Johnston planned to attempt as many effects as possible by practical means.

For Johnston, the appeal of *The Rocketeer* was in its opportunity to conjure up a time when a rocketpack was the height of technological wonderment and it was pure adventure just getting a racing plane into the wild blue. “One of the reasons I wanted to do *The Rocketeer* was because of all the period aviation,” said Johnston, himself an ultralight pilot. “Doing the film, I was able to have this toy box full of antique planes, classic cars and hundreds of extras in period wardrobe.” For the ILM effects team, having a company alumni at the helm was a

decided treat and a key factor in keeping the complex production on track. “Joe Johnston’s such a visual director,” said effects producer Patricia Blau, “that he can storyboard a movie from beginning to end and shoot precisely what he needs without having to overshoot in all directions and figure it out in the editing room later. His clarity in that direction was really helpful.”

One of the production challenges was creating Chaplin Field where Cliff and Peevy rent hangar space for their racing plane. Not only did the setting have to be big enough to stage an effects plane crash and a real airshow, but the skies above had to be period blue, not smoggy. Eventually selected was the California community of Santa Maria, about one hundred fifty miles north of Los Angeles. “L.A. in the late 1930s was little more than a desert valley with hills and trees and orange groves,” explained executive producer Larry Franco. “Santa Maria looks like that today — at least where we were filming.”

The airfield set was created on a large, empty expanse that had once been the taxiway for an old bomber airstrip. “We knew we needed a grandstand for the air circus, a hangar where Cliff’s racing plane is housed, and an office for Bigelow, who ostensibly owns the airfield,” said Bissell. “Since the two principal visual elements were the main hangar and the grandstand, we looked at their relationship to the runway and arranged them in a way that was appropriate to the way light traveled over the location site.” Detailed architectural models were fashioned to determine not only the photographic requirements of the setting, but also the needs of the aerial coordinator and stunt people. “Using a halogen lamp to show how the sun would travel over the set was extremely useful for planning a shooting schedule. After working that out, we could position the other pieces as compositional elements. We built two facade hangars to add to the airfield’s overall feel and added some forced perspective oil derricks to capture the free-spirited wildcat era of Los Angeles.” A ten-person construction crew spent seven weeks erecting the airfield structures, while subcontractors bulldozed the worn and neglected bomber field into the soft dirt runway necessary for receiving the biplanes and racing craft of the period.

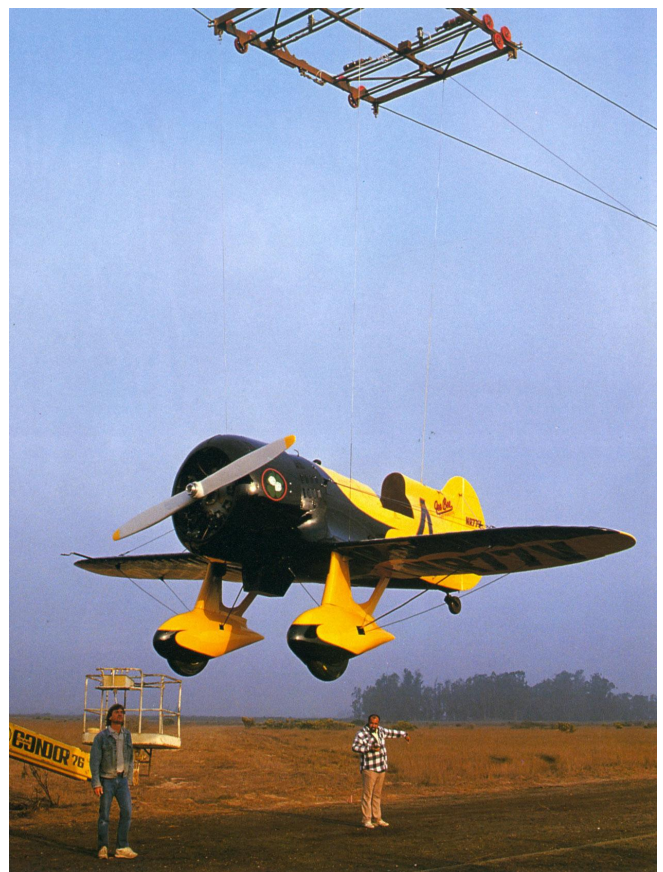
The signature plane of the movie is the racing Gee Bee. The original Gee Bee, a stubby airplane built on the concept of the smallest airframe around the largest engine, won the 1932 U.S. National Air Races in record time. Despite its success, the legendary craft has a tragic history. “The Gee Bee was the first three-hundred-mile-an-hour airplane,” said aerial coordinator Craig Hosking, “but it was also very unstable. Every Gee Bee ever built has been crashed — including the replica we used in the movie. When Disney bought it, the plane had been damaged in a landing accident when the guy who built it had a brake problem and ended up going off the runway and putting the plane on its back. Since the Gee Bee is so short, it’s very difficult to take off and land. Back in the Thirties, no one knew anything about ‘high-G loading’ or ‘induced stall’ where even at speeds of two hundred miles per hour the air foil on the wing can stall if you load it up. Going around a corner, a plane can pull three or four times the force of gravity; and the Gee Bee wing just wasn’t able to hold that much weight in a turn. The plane would stall and hit the ground. The air racers with their Gee Bee planes were the first to explore that regimen, but it cost a lot of people.”

Hosking was responsible for securing and maintaining the period airplanes and also served as the primary helicopter pilot for the aerial camera operator. Hosking also won Gee Bee flying duty when Steven Hinton, the scheduled pilot, was sidelined because of an unrelated injury. Prior to Hinton's injury, the two had modified the dangerous airplane. "We had good, solid landing gear put on, different wheels, tires and brakes," said Hosking, "so those of us who flew it at least had a fighting chance to keep it on the ground when we were landing it."

The opening sequences of the film, featuring a Gee Bee crash, required a full-scale mockup to complement the flying replica. The mockup, built by special effects supervisor Jon G. Belyeu and his crew, was also planned for use in the first scene on the shooting schedule, the big finale in front of the Bulldog Cafe, the favored hangout for the Chaplin Field flyboys. "We determined that we would go ahead and build a complete, perfect Gee Bee replica because the filming for the final scene required a lot of closeup work," stated Belyeu. "As a result, we got into even more detail than we had anticipated. The plane wasn't just a shell. It weighed one ton and was about twenty-five feet long with a twenty-four foot wingspan. If you had strapped a motor on that thing it would probably have taken off. Craig Hosking even made the comment that he would rather crash in our Gee Bee than his plane. It was that superior in real construction."

The mockup, which was also equipped with radio control devices for the effects work, required nearly six months of research and development. For the construction specifications, a Gee Bee blueprint was secured — from a toy model. "We took the blueprint from the toy set and had it blown up to full scale by a blueprint outfit," Belyeu said. "In addition to the blueprint, we took a lot of photographs of Disney's flying replica and a book on the Granville Brothers, who were the original builders of the plane. To build it took a construction crew of ten guys. We started off with a steel tubular frame and around that we used plywood cutouts for the sections. For the outside, we used panels of Douglas fir. Over that we put fiberglass cloth to represent the fabric of the old aircraft. After we did the scene of it arriving at the Bulldog Cafe, we took it to Santa Maria where we rigged it for the crash scene."

The film opens with Cliff taking his newly constructed Gee Bee — which he hopes to pilot all the way to the National Air Races — on a maiden flight above the rolling hills surrounding Chaplin Field. Closeup shots of the pilot's canopy reveal actor Bill Campbell behind the goggles of his leather flight helmet. The illusion of Campbell at



The film opens as Cliff takes to the air in a brand new Gee Bee racing plane that he and Peevy hope will win them top honors in national competition. A chance passage over a shootout between FBI agents and mobsters results in his plane being strafed by machine-gun fire. Attempting an emergency landing back at the field, Cliff strikes the mobsters' car which has pulled out onto the

the controls was the first of many practical stunts in the film. “We didn’t want to put Bill in a mockup and do a bluescreen effect because of Joe’s desire to do as many practical shots as possible,” said

Hosking. “To get the effect, we basically took the

back half of an old Waco biplane and built a Gee Bee mockup out of it. We did that by raising the rear seat fourteen inches and building a special canopy with a top fuselage and back half to match the Gee Bee. The biplane is actually a three-cockpitted craft built several years ago for film work by Jim Franklin, a friend of mine in the airshow business who was also one of the race pilots in *The Rocketeer*. I was in the first cockpit piloting the plane. Bill was in the rear cockpit which had flight controls so he could hold onto the stick and follow what I was doing as if he were flying the plane. In the middle cockpit we mounted the camera facing Bill. From my position, I could roll the camera and operate the special effects rigs for smoke.”

The reverie of Cliff’s flight is shattered when he passes over a car full of FBI agents pursuing a Ford roadster. Seeing the Gee Bee above, a gunman in the roadster’s rumble seat strafes the plane with machine-gun fire. Leaking oil and trailing smoke, the crippled Gee Bee returns to the airfield for a desperation landing as the two cars roar onto the Chaplin Field runway. The luckless aircraft strikes the windshield of the mobster’s roadster, severing its right landing gear in the process and belly-crashing along the runway. Cliff is able to walk away from the landing — but it is of little solace to him in light of his now dashed hopes of winning the Nationals.

As a lead-in to the actual crash, Hosking flew the Gee Bee on a collision course with the roadster, coming to within twenty feet before pulling up and over the onrushing car. The crash itself would employ the Belyeu mockup flown from cables rigged to a pair of one-hundred-ton cranes parked five hundred feet apart and at right angles to the runway. “In that five hundred feet,” Belyeu explained, “we had to bring the Gee Bee up to full-speed, hit the car at the exact spot the director had predetermined, and then be able to arrest its motion before it got to the end of its run. From the ground, we had two sets of cables running up and over crane A to crane B and down to the ground again, with a carriage that rode on them. Suspended twenty-five feet below the carriage from three smaller cables was the mockup. That carriage was controlled by an endless — a series of cables that went down to a pickup truck parked out of the shot that would run back and forth, in effect towing the Gee Bee in front of the cameras.” The cables, one hundred feet off the ground for most of the five-hundred-foot run, dipped at the midway point to fifty feet where the suspended mockup was calculated to smack into the roadster’s windshield. Coming from an opposite, but offset path from the Gee Bee tow vehicle, another truck would pull the driverless roadster via a tiller bar connected to the front. “This effect was a one-shot deal. We didn’t have a spare plane or a spare car. We had a window of opportunity of only about fifteen feet where we could make impact — and I had a quarter of a million dollars riding on that one shot, just for the mechanical special effects.”

Prior to the shoot, the crew calculated the logistics for the effect with a Gee Bee weight mockup. “We practiced with the weight mockup for about a week before we ever put the real mockup on the wires.” Tests determined that to achieve impact at the predetermined spot, the Gee Bee needed to be towed down line at a top speed of forty miles per hour, with the second

runway. A full-size Gee Bee mockup was constructed by the special effects team, under the happy guidance of a multitude of subsequent script supervisor Jon G. Belyeu, and suspended from a cable rig for the crash scene. In the *Waco* crash scene, a plane bearing impact coming from the rear of a truck.

driver starting up three and a half seconds later at a speed not to exceed twenty-two miles per hour. “It was nerve wracking, but the plane’s right landing gear stuffed itself in the roadster’s windshield and ripped its top off. That was a cut. Then we reset our cranes, lowering the cables down so we could have the mockup landing on its one remaining gear before the wheel, unable to support the weight of the plane, blows out and the Gee Bee belly-lands and skids.” Radio control mechanisms enhanced the effect. “We had six or seven guys standing off on the sidelines running various radio control effects inside the plane. The radio frequency would activate a servo which would then activate another relay that would turn on the propane for the flames or a sequential firing device to activate the sparks and smoke effects. The radio frequency even activated a twenty-two-horsepower motor that drove the propeller.”

After the mobsters are taken away — the driver to the hospital, the gunman to the morgue — Cliff and Peevy discover a fantastic double-cylinder rocketpack hidden in their hangar by one of the fugitives. But before the all-too-willing pilot could be transformed into a jet-powered hero, the production had to evaluate the ensemble look of Stevens’ comic book character, beginning with his trademark flying fin helmet. The vaguely insectlike look of the eye visors and mouth holes and the aero-dynamically sound tail fin reportedly made the helmet a tough sale to the Disney brass. Joe Johnston made a successful case for retaining the look of the comic book helmet, integral as it was to the iconic image of Stevens’ character. Helping to carry the day was sculptor Kent Melton, whose helmet design followed the original comic book image and was accepted by the studio. “I was quite glad it got accepted in one take,” said Melton. “Dave Stevens is a friend and it helped to have him working on it with me. Joe Johnston stressed that the helmet had to look like it was made overnight — which Peevy does in the movie. The major challenge was that Dave draws the helmet in the comics about the size of a man’s head. We had to design a helmet big enough for a man’s head to fit inside, but not so large that it would look as if the actor had a bucket on his head.”

The helmet creation began with a plaster lifecast taken from the head of one of the stuntmen. “I took photos of the lifecast both in profile and from the front. Then I had prints made, blew them up to life-size, and had Dave Stevens actually draw the helmet right on top of the photos. With the look worked out, I was able to begin sculpting. I covered the plaster lifecast with foil and



Leaving a trail of smoke and fire, the Rocketeer lifts off on his first flight Stuntman Michael De Luna was suspended on wires from a crane and yanked up quickly by means of a counterweight and pulley system. A practical rocketpack devised by the Belyeu unit spewed out live flame which was later enhanced with animation effects provided by Industrial Light and Magic.



The air circus sequence in which Cliff overtakes an out-of-control biplane and pulls his unconscious friend Malcolm from the cockpit employed a wide range of both physical and optical effects — full-size and miniature — plus extensive live-action stunt work.

worked the clay directly on top of it.” Melton sculpted one side of the helmet at a time. Then, using wood carving tools, he added rivets, welding beads and other details. The final helmet, cast in fiberglass with a wooden blade for the fin, was painted to look like bronzed metal. Although the look was essentially faithful to Stevens’ original design, the helmet was a tight fit for the man inside. “It was not always comfortable to wear that helmet,” Bill Campbell observed. “There were two bolts that kept the eye lenses in place and they sort of pressed into my frontal lobes. Also, the lenses had a tendency to fog up, so everything looked like it was in mist. But aside from being incredibly painful, it was nice and a real joy to wear.”

The most important, and complex, piece of the Rocketeer’s outfit was the rocketpack itself. In the comics, the pack was a cylindrically shaped engine with one major port, a design the filmmakers had to adapt into not only an aesthetically pleasing form, but a practical effects unit capable of emitting real flames. “One of the problems any director or production designer will tell you,” Bissell observed, “is that an artist can draw something that works fine for different drawings, but to create a three-dimensional object from those drawings can be a difficult design problem. To use the rocketpack design as it had evolved in the comics would have looked really awkward on a real person’s back. In his comics, Dave could draw the pack to look streamlined and dynamic; but we couldn’t actually do that. At the same time, we knew what we wanted it to look like because stylistically Dave had explored that terrain.”

“One of the design concerns was that it look more haphazard, more like a prototype,” elaborated visual effects art director John Bell, who assisted with some of the early rocketpack concepts. “That was going to help give the element of danger — wondering whether or not this thing was going to hold together. At the same time, the rocketpack had to be fairly beautiful looking and simple. When you look at it, you have to understand how the thing works. To come up with a design, we had to put ourselves in the time period of the film and consider what materials were available and the technology of the day. I came up with a lot of things like turned metal and exposed tubing for the fuel lines. Inspirations from period technology included early aircraft and World War II footage of German rocket thrusters. Some of the initial designs were very elaborate, with glass fuel bottles retrofitted onto the pack.”

During the nearly eight weeks required to lock in a rocketpack concept that was both functional and aesthetically pleasing, art department designer Henry Darnell worked closely with production illustrator Edward Eyth to devise something that looked prototypical and yet had the appearance of an invention that might have been fashioned with the resources of a Howard Hughes. The challenge was resolved by creating a dual rocket unit with a compact, flattened look. “For the final rocketpack,” noted Darnell, “Ed pointed out a technique of spraying metal into a mold. BJB Enterprises uses an arc-spraying device that sprays metal at ninety pounds per square inch of pressure. So we took a two-piece mold of the rocketpack’s front and back — which was a negative of all the outside surfaces complete with rivets and details — and had BJB arc-spray metal into the cavities of the molds. We reinforced the metal with fiberglass and fiberglassed the two halves together. Then we added on thrusters and vents. We got the finished rocket shell to Jon Belyou and he took those pieces and had aluminum castings made.”

Belyou also had the responsibility of bringing the rocketpack to life with an actual flame burn effect. “Originally, the pack was designed as a single-flame pack with just one motor. When the

final design called for two motors and two flames, the area inside the pack actually got smaller. The look of the jet thrust — and the director was very specific about this — had to start off emanating at a four-inch diameter, and within fourteen inches it had to come to a pin-point. The tongue of the fire had to maintain that full-thrust appearance even when the Rocketeer was turning or moving. When we actually had the rocket turned up and running perfectly, the flame was invisible. So we had to induce a liquid mixture into the jet stream of the fire for it to be photographable — to even be seen by the naked eye.

“When you see the rocketpack in practical operation, there are two tongues of flame coming out, one from each port. The rocket itself had tiny cylinders of high-pressure methane gas controlled by an electric valve. When stimulated, the valve would open and allow the gas to go into a little engine we had built, at which point the wearer would push another button that was connected to the ignition system. For the ignition system, we used a single 110,000-volt stun gun and reconfigured the wiring system to produce a large blue spark. While a conventional sparkplug can throw a blue spark maybe a quarter-inch long to induce combustion in an engine, the stun gun effect threw a blue spark more than an inch long that immediately set the gas on fire. We had to be very careful using the stun gun, particularly about any line loss or leakage from the electrical side. When you get up to 110,000 volts, that electricity will seep through the shielding of a lot of different kinds of electrical wire. Using the stun gun for the ignition was the hardest thing to work out because we had the air fuel mixture just at the point where it became so oxygenated that it was hard to ignite. But it had to be at that oxygen level in order to produce the pointed flame the director was so specific about. So it became a very complicated process to get the rocketpack to work. After five months of total research and development, we ended up building three packs — each costing about \$100,000.”

At its source, Jon Belyeu discovered that the practical flame burned at fifteen hundred degrees — five hundred degrees at its outer edges — a level of heat that would easily burn through the fiberglass material originally planned for the rocketpack shell. An aluminum shell successfully encased the fire-blasting unit. The packs, which had a flame duration of less than sixty seconds between refuelings, were ignited by the wearer via a hand control system — the right glove activating the fuel system, the left glove button turning on ignition. “Although our rocketpacks had no real thrust,” said Belyeu, “by the time we had finished, the basic concept was exactly the same as a turbo engine. The cylinder and the chamber’s configuration inside created what we call a vortex so that as the flame burned, it sucked in more air than it actually needed — the thrust look coming from the additional air being sucked in.”

Although stop-motion puppet work was scheduled, the major Rocketeer flying shots were originally planned as practical effects with stuntmen suspended on wires thirty feet below a helicopter flying at top speed. “The harness we used was a mixture of steel and fiberglass form-fitted to the stuntman’s body,” explained Hosking, who was at the helicopter controls. “The stunt-man got into a prone position on a chest tray that went from the front of his shoulders down to his knees. This plate had two straps that came up over his shoulder like suspenders and then down along the back. The wires, rigged by wire expert Bob Harman, were attached at three points — two points down by each knee, one up by the base of the helmet. I’d take the helicopter up a bit, hovering slowly and carefully until the lines got tight, then fly away with the

practical flames burning from the rocketpack.” Unfortunately, it proved physically impossible to get the live-action speed the director desired. “Joe Johnston wanted the Rocketeer flying at bullet-speed. We found the stuntman was most stable hanging out of the helicopter at sixty miles per hour. Some of the shots we undercranked to eighteen frames per second, sometimes slower than that. To me, it looked fabulous; but I wasn’t the director. Joe ultimately went with a different approach.”

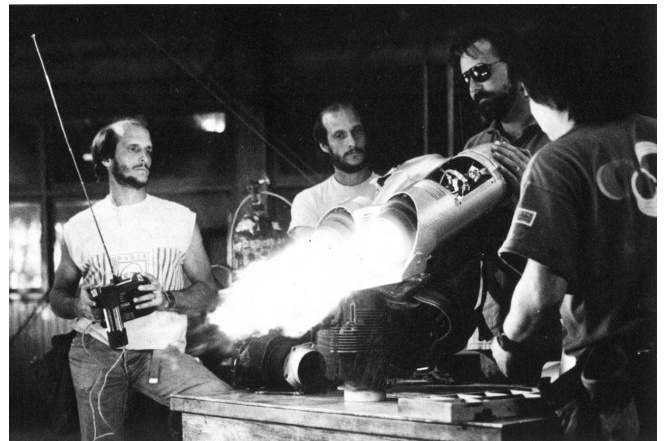
The different approach meant additional shots for the ILM stop-motion crew. “Originally there wasn’t a lot of faith that a stop-motion puppet would hold up that well” said Patty Blau, “so the plan was to use it for shorter, more distant shots. But when the production people saw the film of our stop-motion puppet work, it astonished a lot of them. The puppet looked so good that, later in the movie, shots that would have been considered to be too close to the Rocketeer for stop-motion to work were in fact shot as blank plates and sent to ILM. This helped speed things up on the set when they didn’t have time to spend rigging an actor on wires.”

The stop-motion Rocketeer was built in the time-honored way, beginning with chief sculptor Richard Miller and armature designer Tom St. Amand working out the details for the quarter-scale figure using photos of the actor as reference. Constructed first, the St. Amand armature would serve as the basic form over which Miller would lay in clay and sculpt the master image. “I worked for about four weeks and built two quarter-scale armatures,” said St. Amand. “They were the usual type, a combination of ball joints and hinge-and-swivel joints. For the stop-motion work, the puppet had mount points on the side, the top and the butt — also from the chest toward the front for a couple of shots where he’s flying away from camera.”

For his sculpting, Miller employed an oil-based industrial design clay used extensively for making master molds. “The clay I used is good for tight detailing and it’s a little stronger than most, which allows it to go through the mold process without much worry about damage. For the hands, I used



To avoid the look of process photography in scenes of the Rocketeer trying to free Malcolm from his cockpit, the vintage biplane was mounted on a gimbal at the edge of a steep cliff overlooking a mountain range. By employing wind machines and gently rocking both the plane and the camera crane, a convincing simulation of air-to-air photography was achieved.



In the hangar set where Cliff and Peevy are about to discover the found rocketpack’s full capabilities, special effects crew members Rick and Ron Zarro, Jon Belyeu and Bruce Kuroyama test their prop pack’s practical operation. A sixty-second supply of high-pressure methane gas was ignited by a stun gun spark to create a powerful tongue of flame from each rocket port.

wax. I like wax because it enables me to get more definition. I'll rough the hands in clay, but eventually cut them off, build them out of wax and put them back on."

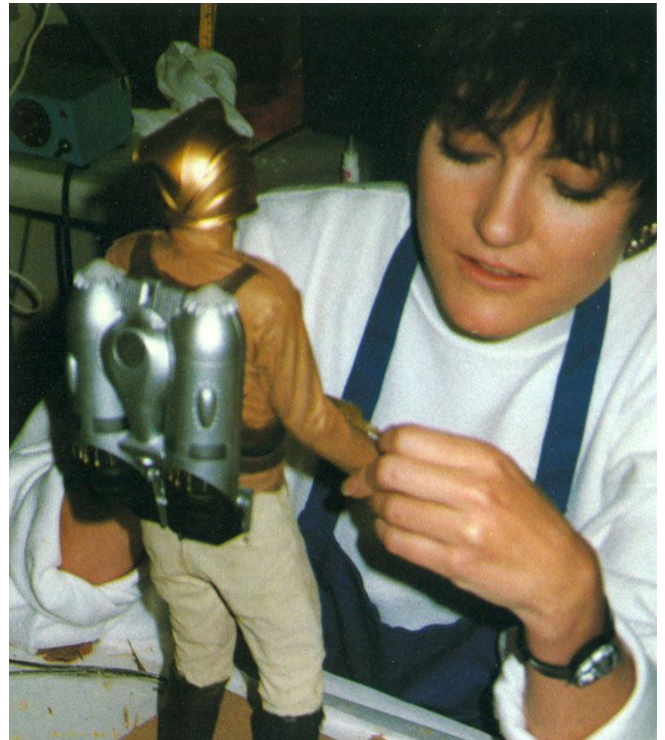
Molded and cast in foam, the puppet was costumed and provided with a rocketpack — built by supervising modelmaker Steve Gawley — that was fastened with a single screw to the armature's backbone. Flashlight bulbs inserted into the rocket-pack port openings provided a lighting guide for the flame effects that would be composited in later. The illusion of super-speed flight was accomplished jointly by motion control programmer Peter Daulton and puppet animator Tom St. Amand. "With a real guy there are always safety considerations," said St. Amand, "but we could take our eighteen-inch man and fly him a hundred miles an hour. The speed comes from just how fast the puppet is programmed to move through frame. We experimented with different test programs until we got the speed we needed."

Although go-motion puppetry has become an ILM staple, it was determined that the Rocketeer work would not benefit significantly from the employment of computer-programmed actuating rods on the puppet. Old-fashioned stop-motion was considered more than adequate. "Almost every one of our shots had the Rocketeer jetting through frame with the motion control camera moves providing the motion blur," said Daulton. "The camera was on an eighty-foot track. All axes of the camera were motorized, programmable and repeatable for pan and tilt along the whole length of the track. The puppet was mounted on a programmable rotator and pylon so the model itself could rotate around and assume the correct orientation and direction. I programmed each camera axis one channel at a time and blended all the axis moves together to provide what looks like a fluid flying motion. We would do black-and-white move tests that we would show to Joe Johnston or Ken Ralston for their direction or suggestions. Then we would photograph the puppet one frame at a time with Tom St. Amand coming in and manipulating the puppet between frames."

One of the biggest preproduction concerns regarding the puppet work was the physical appearance of the Rocketeer in flight. "When we talked to Joe and Ken," stated St. Amand, "they were insistent that they didn't want a character who flew like Superman with his arms out in front. That's why for most of our shots the Rocketeer's arms are at his side." To match the live-action work, it was necessary to duplicate the rocketpack's practical flame effect. "We decided that animation might be the way to go with the flames," said animation supervisor Wes Takahashi. "We've animated flames in the past, but they were pretty much ancillary to the shots. The Rocketeer jetpack flames needed to, in effect, act or change shape and form depending on the shots. I knew it would be a challenge. I called my group of people my 'flame crew' because they could all handle fire and flame without going through a big learning curve."

During the research and development phase, Takahashi and optical supervisor John Ellis strove to create an animated rocket flame with a powerful thrust appearance, but a minimum of visual elements. "We were able to minimize the rocket flame elements to just an outer flame and an inner core that gave not only a luminous spectrum, but a color spectrum," Takahashi continued. "The final design of the flame was arrived at by Joe Johnston, Ken Ralston, John Bell and me just working with the look of the flame. We drew the flames frame by frame in black-and-white so we could give optical a clear window element."

Every frame of each selected plate shot was made into an 11x14 photostat with animation peg-hole registration, thus allowing the flame crew to work at their own desks or light tables rather than under a rotoscope camera. To save time, it was decided that optical would take the black-and-white flame animation and add color. "All I had to use was one color filter," said Ellis. "Wes came up with the idea of texturing the inside of the flame envelope so that when photographed onto high-contrast film the flame element itself would be clear with portions of it going a little bit darker from the texturing. By taking that and printing colored light through it on our own optical printer, we were able to get more than one color in the flame area. If we had just a clear window, without the texturing elements, and put some orange light through that it would have looked too flat. The texture in the center of the flame and diffusions on the edges acted like a neutral density filter that allowed different exposures to come through that area. Basically, it allowed the flames to not only have more color ranges, but a three-dimensional look as well." Different flame densities were developed to work against the varied backgrounds of night and daylight, and the flames were also color balanced to fit each plate.

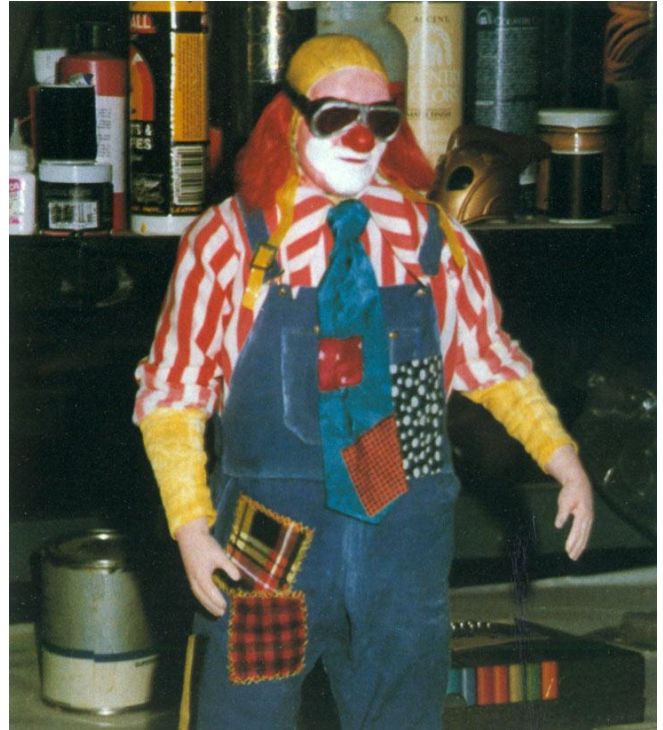


Not all of the Rocketeer flying material was achieved with live performers. More than thirty shots in the film employed stop-motion footage featuring a quarter-scale puppet sculpted by Richard Miller and costumed by Jean Bolte. Supervising modelmaker Steve Gawley fabricated the tiny rocketpack which featured a small halogen light in each engine port to provide light cues for animators rendering the flame effects.

The initial appearance of the animated flames occurs in the Chaplin Field hangar when Cliff first turns on the rocketpack. With an explosive blast, the pack careens around the structure, crashing through a wall before coming to a stop. "The shots of the rocketpack bouncing around the hangar had all animated flames," said Bell. "We had a shot of the background plate and instructions from Joe Johnston on how to program the rocket. We set the pack up on wires against bluescreen and shot the move with a slower shutter speed so the pack looks like it's traveling faster than it actually was. Once the bluescreen was done, the shot went to animation where they worked on the flames. Then all the elements went back to optical for compositing."

The first actual flying sequence takes place during a performance by the daredevil pilots of Bigelow's Air Circus. Having lost his race plane in the crash, Cliff is forced to do his old air-show stunt of dressing in a clown suit and flying a rickety 1916 Standard biplane. When Cliff is late, Malcolm, an old friend and airstrip jockey, dresses up in the suit and takes to the air. When Cliff finally arrives, he sees that Malcolm, well-meaning but rusty with the stick, has the plane smoking, sputtering and flying out of control. His friend is doomed — unless the Rocketeer can fly to his rescue. "Malcolm's rescue is the most complicated sequence, effects-wise, in the movie," said Johnston, "and we used just about every technique at hand. We used puppets and bluescreens and practical stuff where the Rocketeer's either on a helicopter skid or hanging by wires, with computer graphics doing wire removal. I don't think the audience realizes where one technique ends and another takes over."

Staging the air circus required seven hundred extras from the Santa Maria area to fill the Chaplin Field grandstands. Craig Hosking arranged the aerial action and flew the helicopter camera unit during the four days of filming. "All



A similar puppet was made to represent the Malcolm character who is dressed as a clown for his aerial circus performance.



Animator Tom St. Amand — who also built the puppet armature — manipulates the stop-motion

the planes were vintage 1938 or earlier,” Hosking noted. “We didn’t have time, except for a few exceptions, to bring a lot of old planes up to snuff, so my job was to find planes that were ready to go and guys to fly them. The 1916 Standard biplane that Malcolm flies is one that took a little work to get ready. Among other things, we had to modify the wing for some stunt work and rig it with a smoke system so it would appear to be in trouble.”

Rocketeer between exposures. Movement of the character through the frame was achieved via motion control camera moves programmed by camera operator Peter Daulton.

One of the flying stunts had Malcolm’s biplane soaring past the grandstand and into the path of four air racers which split at the last moment. Hosking and his flyers drilled the stunt more than six times to arrange the aerial and ground coverage Johnston desired. “I had a camera mounted on the nose of the helicopter looking straight ahead,” Hosking explained, “and I was flying very close — about five feet — from the tail of the Standard with the four race planes coming at us. On my cue, Chuck Wentworth, the Standard pilot, turned on the smoke device effect for the plane in trouble. I ducked the camera down in the smoke, right in there with him, and then on another cue of mine the race planes all peeled away and the Standard and I flew right between them — a head-on near miss. The whole scene was supposed to look out of control, but in reality it was extremely well planned. Everybody had an assigned place in the sky.”

To save the day, Cliff finally straps on the rocketpack, puts on his helmet and steps out of the hangar for his first flight as the Rocketeer. “The liftoff from the hangar was a combination of several elements,” Hosking observed. “There was an aerial shot taken from the helicopter of the stuntman being lifted up by cables and spiraling off the ground. There was a cut of him being lifted vertically by a crane. And finally, there was an ILM puppet shot of the Rocketeer racing away.” For the vertical liftoff, a crane was positioned above the launch point with cables extending down to a flying harness hidden on the Rocketeer stuntman. The actual vertical move — lifting the stuntman up at ten feet per second — was powered by pulling down on a counterweight connected to a series of pulleys. Though the rocketpack spewed practical flames for the shot, the effect was later augmented by the ILM animation crew.

The flight itself would feature some twenty-one puppet shots — about two-thirds of the entire stop-motion workload. Since the action had been building to the Rocketeer’s first flight, the flying had to pay off with big thrills. “What scared me to death was the thought of ending up with Tinker Bell flying, floating and touching down on tippy-toes,” said Dave Stevens. “My intent with the flying was to give the appearance of a guy totally out of control with this bomb strapped to his back and going hundreds of miles an hour. I wanted to impart to the audience that this was really scary. What this guy’s doing had never been done before and he could die at any moment — just go straight into the ground.”

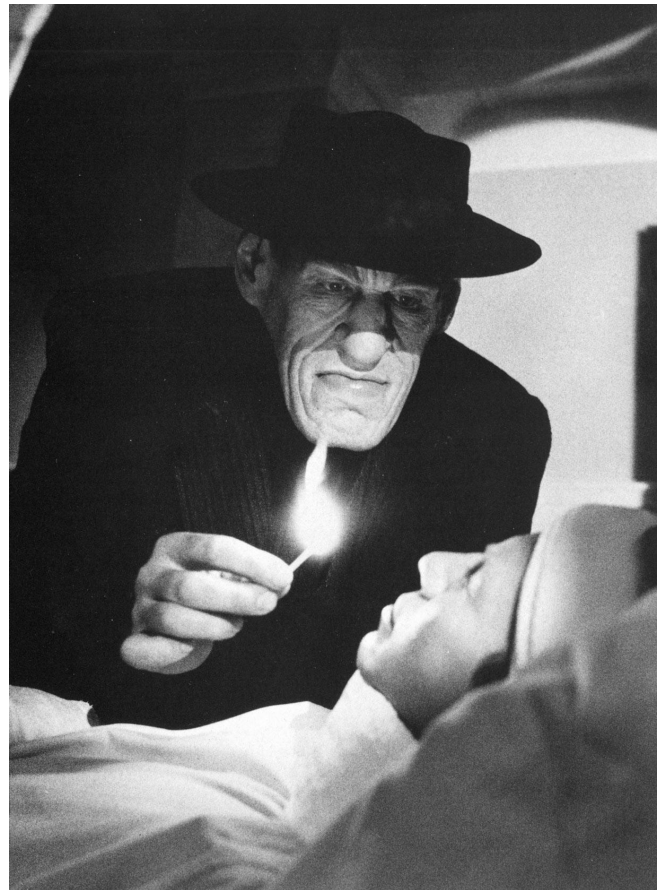
The filmmakers agreed with the concept of serious rocket power. “In the first few stop-motion flying scenes,” said Daulton, “it was decided that the Rocketeer should be out of control. Later in the movie, he’s more used to the pack, more under control. Tom St. Amand and I would talk with Joe Johnston about what he wanted in terms of character animation. The Rocketeer puppet was like an actor and had to react and move a certain way depending on the particular shot. Once we got that information, I would program the camera move; and at that point, my job was

pretty much done. I would just set up my crew so they'd start shooting with Tom one frame at a time."

As the Rocketeer blasts into the sky, overshooting the Standard, he goes through a dizzying range of motions: zooming up in a loop-the-loop, losing engine power at the top of the loop, starting to fall, regaining power, jetting toward camera and up and out of frame, then coming back down into view. "When you do effects shots like this," said St. Amand, "the fear is that people will get confused. 'Where did he go? He's gone! Oh, there he is!' But those were things I would suggest to Joe from time to time — and he was open to suggestions. We could afford to experiment once in a while, and it was up to Joe to say 'yea' or 'nay.'" Technique, as always, was essential to producing quality animation. "When I'm moving a figure frame by frame, it's really important to me to always do things in the same order — head, shoulders, arms, hands, body, hips, knees and feet. That makes it easier to keep track. Also, you should move the figure every frame, even if it's just a really small move. If the Rocketeer puppet was perfectly still, it would look like a flying cigar. The figure should drift — the arms should move from side to side, the head should lead and the body should follow. I would make notes based on what Peter had done with the camera move. Looking at his frame count helped me anticipate the movements to come." Though traditionally very time consuming, the stop-motion shots in *The Rocketeer* were usually no more than two or three seconds in length and could generally be animated and photographed in two to four hours.

A number of shots in the sequence did utilize practical flying effects. One such shot had the Rocketeer flying directly over the grandstand with the camera above him. Instead of a wire rigging, the shot was achieved with a flying harness attached to the outside of the camera helicopter. "The flying rig extended out eight feet forward and diagonally to the left side of the helicopter," Hosking explained. "The stuntman lay down in an aluminum structure that extended under his chest and thighs and was connected to the skid where it was supported with trusses holding the rig in position. The camera was then mounted on the helicopter looking over him."

Practical effects were also used in a shot of the Rocketeer catching the biplane wing. "Conventionally, you might shoot the plane against bluescreen and later add the aerial footage," said director of photography Hiro Narita, "but that always looks like a process shot. We did our shot on a cliff a couple thousand feet in the air — a straight drop. We had a Standard mockup mounted on a crude gimbal that just rolled and



In the employ of Neville Sinclair — a swashbuckling movie star and master Nazi spy — is the brutish Lothar. With features inspired by the singular physiognomy of Forties horror actor

rocked at the Cliff's edge. My camera was mounted on a crane, so we shot mostly from the front toward the rear of the airplane — about a three-quarter look. The camera was free from the airplane, so we could move the camera left and right and up and down to make it look like we were flying together. With the space around it, and by showing a little bit of the hills in the distance, we created the illusion that the airplane was really high up."

Bondo Hatton, the Lothar character was achieved during the production. Makeup artist Greg Nelson spent more than four hours each day applying the Rick Baker for seven-foot actor Tiny Ron. The foam latex pieces and painting them to match the actor's flesh tones.

In subsequent shots, the Rocketeer twice falls off the plane, each time reigniting his jets and giving another go at pulling Malcolm free from the cockpit. One fall had a stuntman dropping from a tail-end Standard mockup suspended below a helicopter. The second fall was off the wing of the real Standard, the stuntman sliding down special tracks designed to direct him straight between the spars and into another free-fall. "Michael De Luna, the stuntman, was actually wearing two parachutes — a full deployment rig and a safety chute — which is always the case in any skydiving or sport jumping," Hosking observed. "In our case, we had to hide the parachutes — which we did inside a rocketpack shell. With special parachute rigs, the guys use springs and drogue chutes to tear away pieces of clothing to expose the parachute itself and get it to open. So when Mike pulled a cord, it tore the facade rocketpack away from him and also opened up his parachute. When filming the fall, I flew the helicopter about sixty miles per hour. As the stuntman fell, the helicopter cameraman just tilted down while I descended."

During one of the falls, the Rocketeer disappears into a cloud. There is a flash as the rocketpack engine reignites, and the Rocketeer flies back up. The cut employed a matte painting of the ground below painted by Yusei Uesugi, cloud cover made of cotton and the Rocketeer stop-motion puppet. "The painting was shot at about a forty-five-degree angle," said matte artist Mark Sullivan, "and the sheet of glass with the cotton cloud effect was laid on top and level to the floor. The camera was mounted on a rig so it could be elevated and looking down through the glass at the painting. The light burst element inside the cloud was added by the animation department."

When the Rocketeer finally reaches the cockpit, the plane is plummeting toward the airfield on a collision course with a fuel truck parked below. The Rocketeer manages to pull Malcolm free just moments before the Standard impacts with the truck and explodes. "We had a camera mounted on the tail of the Standard for an over-the-shoulder shot of stuntman Mike De Luna struggling to pull Malcolm out of the cockpit while the plane's diving straight for the truck," Hosking recalled. "Chuck Went-worth — the pilot doubling for Malcolm — pulled the Standard up to near-miss so we got the airplane's point-of-view of the truck and the ground rushing up. Next we set up a shell for the fuel truck and loaded it with explosives. Then we dropped a full-scale mockup from a crane. It fell down a wire into the truck and the explosion occurred. The plane was dropped vertically, but because of the pilot's POV and the placement of the ground cameras, it looked like the Standard was coming on a diagonal descent angle. The explosion itself was triggered manually by one of the effects guys."

The next shot — a stop-motion effect of the Rocketeer dropping Malcolm safely into an airbag — was a special challenge for Daulton and St. Amand. "It was a complicated shot because there

were two puppets and they were both photographed together,” said Daulton. “My camera move was creating the Rocketeer’s flight path; so while the Rocketeer was holding Malcolm, the two puppets were traveling together. Once the Rocketeer drops Malcolm, their separation required each puppet to be on its own independent mover. Normally the Rocketeer puppet was mounted on a pylon — basically a motorized gearhead that’s surrounded by blue neon to blend in with the bluescreen. For this shot, however, we mounted the Rocketeer from the ceiling and a clown-suited Malcolm puppet was on a pylon mount coming up from the floor. After I programmed the move, Tom animated the Rocketeer to move up and the Malcolm doll to move down so they could appear to separate. The animation was amazing — Tom got it in one take.”



Stagehands dolly camera operator Pat Turner toward a miniature landscape constructed for a pulse-pounding POV shot during Cliffs maiden flight as the Rocketeer.



To effect his escape from the South Seas Club, where all nature of enemies have converged upon him, the Rocketeer fires his thrusters and blasts up through a colorful skylight positioned over the dance floor. The scene — achieved at ILM — combined stop-motion puppet work with high-speed photography of a miniature stained glass window being shattered pyrotechnically.



Soaring into the night skies, the Rocketeer passes over Hollywood and the hills adjacent. Matte artist Mark Sullivan at work on a painting — part of a giant rendering six feet tall and nineteen feet wide — that would eventually become the sprawling backdrop for the Rocketeer's passage over the city.

Malcolm's rescue is not the end of the Rocketeer's wild ride. While saluting a passing plane, Cliff loses control and hurtles down in a terrifying death dive. The ground rushes up — but at the last moment, the Rocketeer pulls out and rockets across the rural countryside. Along the way, he hits a clothesline, dragging a bedsheet which he discards moments before splashing down in a muddy pond. "For the fall," stated John Bell, "we built a twenty-four-square-foot model of a landscape and had it tilted up vertically so the



The Rocketeer erupts in flight from the nightclub and journeys across the period painting rendered luminous with backlit lighting effects.

camera could film the POV of the Rocketeer falling toward earth. We had the set on our main stage, put the camera on a track and pushed it to within literally an inch, or a half-inch, of this model. Because the camera had to come in so close and the footage had to cut with the live-action that followed, getting the ground set to look in scale was a real killer. At first we thought we could get away with just doing a little texturing with paint to break up the surface. But the death dive called for the Rocketeer to be falling into the center of a grassy field. We had to represent not only that texture, but get it to the proper scale. Randy Ottenberg had a great idea where she took regular paint brushes that had the right color — sort of a green amber — and chopped up the bristles until they were a quarter-inch long to simulate a grassy texture."

Chief modelmaker Ottenberg and five associates labored on the high-altitude set — foam construction with not only grass, but miniature orange groves, trees, a dry river bed and some houses. The following shot of the Rocketeer hitting the clothesline and being covered by a white sheet was another piece of stop-motion magic. "Tom St. Amand actually made a little sheet to scale that covered the stop-motion puppet," said Daulton. "We hooked up monofilament wires to the corners, and Tom and some members of the crew animated the sheet, as well as the puppet, frame by frame. The wires themselves were so small that they blended into the bluescreen. We'd keep them taut and change them frame by frame to look as if the sheet was blowing in the wind. The cut where the Rocketeer finally removes the sheet was a real person shot against bluescreen."

The realistic look of the sequence was aided by the application of cutting edge computer technology to any shots with excessive bluescreen blur or compositing problems. Specific shots — such as the one in which the Rocketeer drops Malcolm into the airbag — were digitized and manipulated by ILM's digital effects department which was inaugurated during the Rocketeer production timetable. "A flying figure against a light blue sky has traditionally been a problem for optical," said Patty Blau, "so we would precomposite those scenes in the digital realm and bring them back to optical for flames and other elements. The digital work really helped put the Rocketeer in the sky rather than being the sort of indiscernible blob with a black line around him that is common with this kind of optical." Even the optical department had high praise for the competition. "Digital's strong point is that it can control edge characteristics of elements better than opticals can," John Ellis affirmed. "It's going to rewrite the law book on that and on blurs."

“Blur that’s created over bluescreen doesn’t necessarily look like what’s created when an object blurs naturally over an actual background,” said digital department head Stuart Robertson, a longtime optical colleague of Ellis before moving into the new department. “Even if you capture perfectly that blur and composite it over a different background, you’re not necessarily going to get the correct light balance or color balance — or the amount of definition you see over the scene might be different. In those cases where Ken Ralston felt the blur or the color was not what it ought to be, we went in by hand and essentially painted blur all the way around the character — or painted changes to the flame animation.”

Much like a painter wielding a paintbrush, the digital artist sits in front of a monitor with a digitizing tablet and pen and manipulates the scanned film image pixel by pixel. “Our whole emphasis is two-dimensional manipulation,” Robertson continued. “Creating three-dimensional characters is not what we do. Our mission is photo retouch — compositing a character into a scene and digitally manipulating it. If you consider an optical photography toolbox as having twelve basic tools — with every optical effect achieved through some combination of those twelve — the set of tools you get when you enter the digital realm goes up into the hundreds. Our digital programs basically mimic optical processes; but with the additional tools at our disposal, we suddenly have the ability to cut and paste perfectly or paint matte paintings directly into the scene. The drawback with digital is that it’s still very slow. When you take film footage and scan it into the computer, you’re working with maybe six or seven megabytes of information per frame. Even on a good, fast computer it can take up to a half minute per frame to read all of that information. Optical, by comparison, can process that same amount of information in a twenty-fourth of a second. Because of the comparatively slow, but much more precise nature of digital processing, we found it worked very well to scan in individual pieces, composite them digitally, then scan the result out to film. We would make, in effect, a precomposite. Optical would then put in the rocket flames and other elements. So we were getting the best of both optical and digital.”

Although Neville Sinclair is the principal villain of *The Rocketeer*, the film’s real embodiment of evil is Lothar, the actor’s murderous seven-foot henchman. Lothar’s brutish visage was inspired directly by the late Rondo Hatton, a B-movie actor who appeared in a string of 1940s Universal thrillers — and who features in the 1991 edition of *The Rocketeer Adventure Magazine*. Hatton’s singular physiognomy was the result of acromegaly, a pituitary disorder that causes uncontrolled growth hormone production and elongation of the face and extremities.

Acclaimed makeup master Rick Baker designed the Lothar character. Early in the preproduction phase, Baker had suggested that he be a seven-footer — despite his affliction, Hatton was of average height — which led to the hiring of towering actor Tiny Ron. The final makeup that would transform Ron into Rondo was achieved with separate foam prosthetic pieces for the ears, brow and eyelids, plus one large piece incorporating the elongated, drooping look of Lothar's visage. "I've always liked Rondo's face," reflected Baker, "so doing this character was a labor of love. The final makeup looks like Rondo, like an exaggerated sculpture. One thing that made it look like him is that Hatton had big ears. The lobes stuck out more than the tops of his ears. I stuck Tiny Ron's ears flat against his head and made prosthetic appliances to reposition the Rondo ears." During the production, makeup artist Greg Nelson spent four and a half hours each day applying the Baker prosthetics to Tiny Ron and matching the flesh tones. Baker himself had done an initial application test. "It took twenty different subtle colors for the flesh tone — red blotches, veins, a variety of flesh shades — because skin is not just one color. The final result looked like Rondo — but in the film it seemed too masklike. That was partly because they wanted a stoneface look. Personally, I feel that with a sculpted face you need movement to bring life to it."

Lothar figures prominently in a dead-of-night shootout at the house shared by Cliff and Peevy. The structure was not a set piece, but a real home in a quiet old neighborhood behind the Hollywood Bowl. Not only was the area the neighborhood that time forgot, there were rumors that the house had once been occupied by a young Charlie Chaplin. "Shooting at that location saved us having to build a period house in a period neighborhood," stated Jon Belyeu. "The house was slated to go on the Historical Register in the city of Los Angeles, but they allowed us to go in and do whatever we cared to do as long as we restored it to its original condition. The place was actually in a state of disrepair when we got to it; and I think the city felt we would leave it in better condition than what we encountered — which we did."



In the office of billionaire industrialist Howard Hughes — inventor of the Cirrus X-3 rocketpack — Cliff and Peevy are shown a captured indoctrination film revealing that the Nazis plan to steal the new technology and use it in their imminent campaign to dominate the world. Nazi rocketpack troops soar in formation over a bombed-out city in the provocative short directed by Disney animator Mark Dindal. Stylized black-and-white images — similar to those used in actual Nazi propaganda films — were employed throughout.



A sequence of seven paintings — connected by cross-dissolves — was produced to transform an iconic American eagle into its bellicose Nazi counterpart.

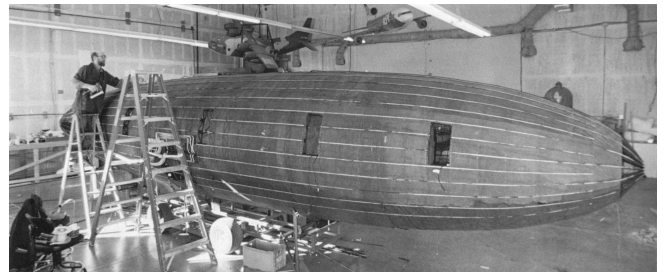
The gun battle required the rigging of more than seven thousand explosive squibs inside and outside the house. “Planting pyrotechnic devices is a very time-consuming process,” Belyeu said. “First we had to remove all of the siding from the house and drill holes into it almost to the wood’s surface. We’d put our squibs in each hole, then pack the back with modeling clay and tape. We had two wires coming off the back, and each of those two wires extended and ran to a nail board.” With the squib-packed siding put back in place, the wire bundles trailed away from the house. The wires were split, with one piece attached to the nail board and another to a battery where the devices could be selectively activated by manual control. A schematic of the house provided the location of each numbered squib.

A world away from the cozy period neighborhood is the glittery South Seas Club where the nefarious Neville Sinclair — aware that Jenny could lead him to Secord and the rocketpack — escorts the would-be actress on a mission of seduction. Determined to thwart him on both accounts, the Rocketeer takes to the sky from the roof of the Bulldog Cafe and soars over the city to rescue his sweetheart. The Bulldog blastoff was the first stop-motion puppet shot worked on by Peter Daulton and Tom St. Amand. Despite the seeming simplicity of the Rocketeer’s blasting off and shooting into the night sky, there were numerous details and challenges. A specific requirement was that the character not fly straight up, but rather in an arcing trajectory. “The concept behind the Rocketeer’s flight path at this point in the movie is that Cliff now knows how to use the jetpack,” noted Daulton. “The blastoff from the Bulldog Cafe begins with the Rocketeer facing camera in sort of a three-quarter profile. You see his front face and his left side as he takes off, and then he rotates around and you see his right side and back. Our major problem was mounting the puppet. Obviously we needed a mounting rod somewhere — but it had to connect in a spot that would never turn toward camera. Otherwise the rod would be visible. Since we see all sides of him in the shot, we had to figure out some way to mount the puppet without the rods getting in the way. What we did for that shot and others like it was build a ball-and-socket joint into the mount rod — something Tom is very good at. Then, instead of my doing a motion control program, the flight path move would be done with animation. Tom would just rotate the model — something that would normally be part of my programming.”

When the Rocketeer appears inside the South Seas Club, his rocketpack blasting, the chic crowd runs screaming for the exits. The nightclub flying scenes — with one or two stop-motion shots included as cover — were performed by a stuntman suspended from an overhead wire rig. For safety reasons, however, the practical rocketpack flames were rejected in favor of postproduction animation. Jon Belyeu and his crew rigged the flying mechanism. “The South Seas Club was a huge set more than a hundred feet long and seventy feet wide. It was also about thirty-five feet tall. To make the Rocketeer fly around in that space, we hung three tracks from the stage ceiling. These three tracks ran parallel to each other along the hundred-foot direction. From those tracks we hung another that worked at a right angle to it. So what we were doing was moving a piece of track, seventy feet long, that was suspended at a right angle to our first track. Under the seventy-foot track — which we called the boom section — we had our Rocketeer suspended. Six operators were riding on the boom track. That was a big piece of equipment. Including the operators, it weighed three thousand pounds. From the boom, our crew could travel along that traverse track and control the movement of our stuntman. We

could make him go up and down on the cables, fly him in circles and do U-turns while maintaining a head-forward orientation.” Any wires visible on film were handily erased by the ILM digital team employing a software program developed for Back to the Future II.

When Sinclair, his mob confederates and Lothar move in on the Rocketeer, Cliff escapes by blasting up through a skylight and then rockets over the city and the adjacent hillside to the north. For that flying scene, the stop-motion puppet was composited onto a matte painting. The sequence was originally conceived as an uninterrupted motion control pan across the scenic rendering, but Johnston later elected to cut the pan into two separate shots. Matte painter Mark Sullivan nonetheless decided to forge ahead and render the two adjacent cuts — one, the South Seas Club and city streets below; the other, the dark Hollywood hills flyover — as one continuous painting. The final oil rendering required a Lexan panel nineteen feet long and six feet tall. “It was one of the bigger matte paintings I’ve ever worked on,” noted Sullivan. “The great challenge of that shot was working out the perspective of the city as seen from the height of maybe twelve hundred feet looking down. Even though I painted the whole scene as one big piece for continuity and convenience, I’m kind of glad it was cut into two shots. Otherwise, perspective problems would have occurred with trying to simulate a wide-angle lens traveling in the air over a vast distance in which things would need to distort around the edges of the lens. With a two-dimensional painting, we couldn’t really do that and maintain the effect over that long a pan. Fortunately, we could make it work by breaking it up into two shots.”

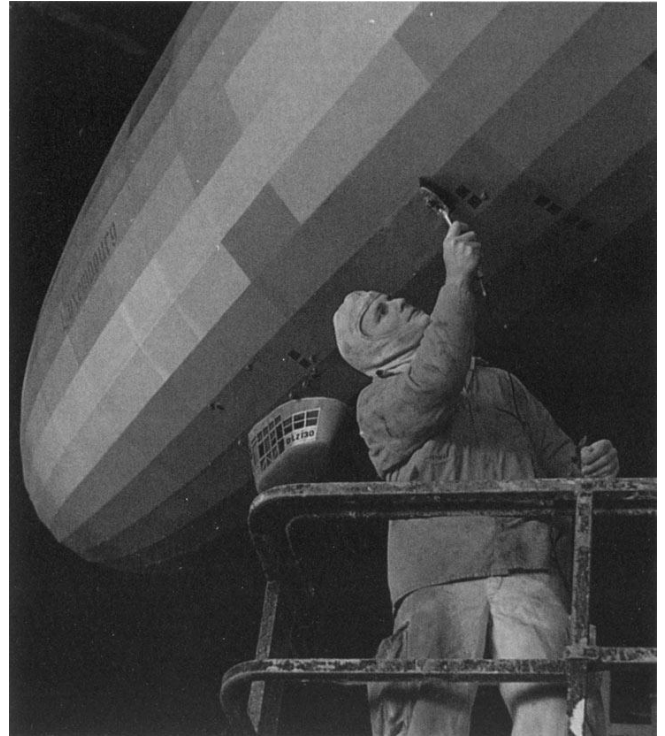


The action comes to a climax on board the Luxembourg — a gigantic Nazi zeppelin ostensibly on a good will tour of the United States — that appears over the Griffith Park Observatory just in time to whisk Sinclair away from a skirmish between Nazi ground troops and a joint contingent of federal agents and patriotic mobsters. Though portions of the eight-hundred-foot-long zeppelin were constructed full-scale, views showing the entire ship were accomplished in miniature at ILM.

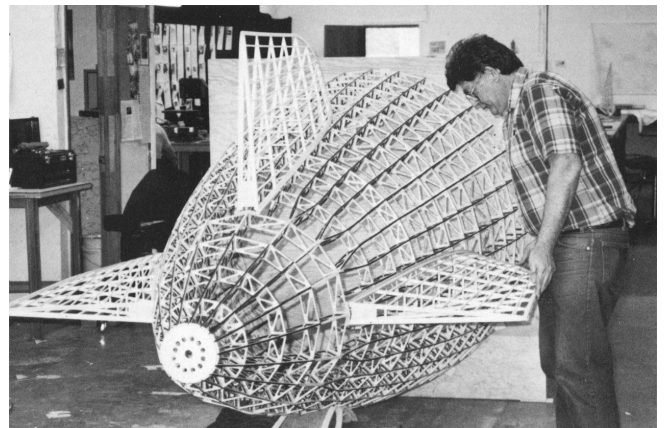
Sullivan first researched photos of old Hollywood, picking out period landmarks that still existed, notably the Security Pacific Bank building. He then commandeered an eight-by-fifteen-foot area of the matte painting workroom and laid down tape to represent streets and positioned some three hundred wood blocks for buildings. Standing over this crude cityscape — which established the perspective required for the painting — Sullivan took a number of still photographs, projected the selected image onto a drawing surface and then drew it out. The next step was to give perspective and identity to the wood block shapes, highlighting the South Seas Club and other iconic structures. That rough drawing was finally projected onto a painting board and used as the layout for the finished rendering.

Sullivan also had to concern himself with accommodating the stop-motion puppet work that was going on simultaneously. “I made a small six-by-nineteen-inch painting of the scene which was shot on the motion control animation stand to work out the move. Peter Daulton and Tom St. Amand used that as a guide for their motion control camera and puppet work. By the time Tom and Pete got to shooting that scene, I had already started on the big painting. I would take their puppet move tests, shoot a separate move over the painting and bipack those two together on the Moviola to see how the puppet moves and the painting were working together. The painting was fairly rigidly designed, so Pete generally had to adjust his program move to work with the perspective and layout of what I was doing. Originally, the dark hills the Rocketeer flies over were painted with the ‘HOLLYWOODLAND’ letters. But with the design of the camera move, they were always going by too fast and blurring so that you couldn’t really read them. To move the camera any slower, though, would have ruined the flow and excitement of the shot; so ultimately, Joe told me to just get rid of the letters and darken out the hills.”

With Jenny now a hostage of Sinclair, the G-men finally catch up with Cliff and Peevy and usher them into the presence of the inventor of the Cirrus X-3 rocketpack — Howard Hughes. For



Modelmaker John Goodson uses an iron to apply a shrink-wrap polyester skin to the largest of the Luxembourg models.



Chief modelmaker Ira Keeler attaches a tail section to the airship. Though the framework in actual zeppelins was made from steel, the ILM crew employed a latticework of lighter-weight plywood cut to exacting specifications by a computer-controlled laser beam.

those who might recall Hughes as the crazed eccentric who died in isolation, the movie recalls the other Hughes — a dynamic motion picture producer and aviation visionary. In the stylish confines of Hughes' office, Cliff and Peevy are shown a captured indoctrination film revealing that the Nazis are after the rocket-pack as part of their master scheme for world conquest. In the black-and-white animated film, rocketpack-propelled Nazis blast off and fly over a bombed out European city, arrows representing the flying Nazi army move westward from Europe to America's eastern shores, streams of flying fascists streak over Washington's Capitol dome like the unleashed monkey monsters of *The Wizard of Oz*, the American flag burns, and an iconic American eagle is consumed by flames and transformed into the Nazi eagle. "The Nazi animation was shown full screen," stated Johnston, "as if the theater has become Hughes' office. The idea was that the theater audience would be seeing it for the first time, just like Cliff and Peevy in the movie. The Nazi animation film was something that was roughly described in the script, but Mark Dindal of Walt Disney animation really designed it and came up with the images."

For Dindal, a visual effects supervisor on *The Little Mermaid*, the Nazi animation sequence offered an intriguing opportunity to play hooky from the demands of house style. "I enjoyed it — subject matter aside — because it was such a different thing from the usual Disney subject matter. For the movie itself, it was a little treat that just added to the whole experience." To design and direct the sequence, Dindal had to immerse himself in the Nazi mindset of the period. "Joe wanted it to look like it had been made by the Nazis' own production house. Looking through the reference material — which included stills from Nazi propaganda films and posters of the period — left a real impression on me. You can't help but be moved by it. Pictures of young S.S. officers that looked like knights of old, glorified shots of the Nazi eagle, the huge rallies where Hitler would be in front of columns draped with giant Nazi flags. It's creepy in retrospect, knowing what it was they were up to, but doing it was intriguing in the same way playing a villain is intriguing for some actors."

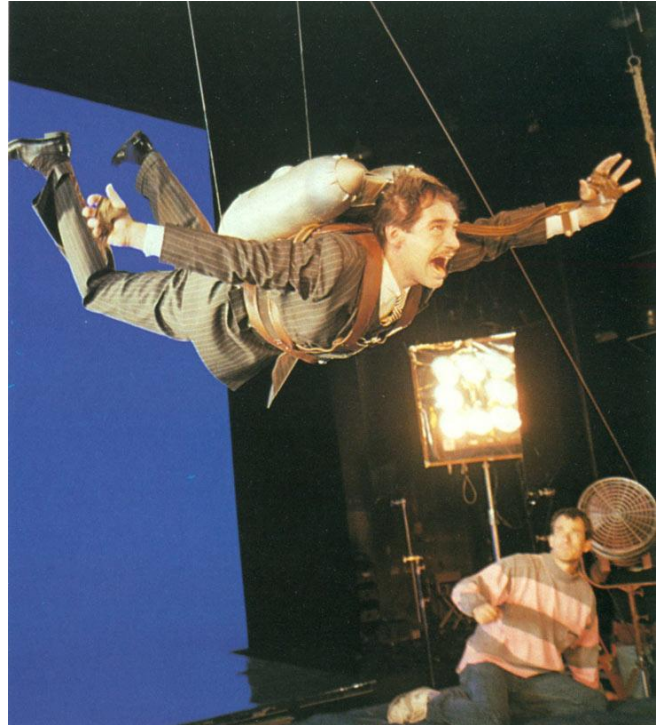
The animation style was inspired by the animated 'Superman' series begun in 1941 by Fleischer Studios and distributed by Paramount. The Fleischer 'Superman' cartoons — considered landmarks in animation history — featured strong, realistic figures, many rendered by rotoscoping and shading for three-dimensional effect. The stories used exaggerated perspectives and a noir atmosphere to create an eerie mood — elements similar to the direct, stylized look of the Nazi propaganda films.

Once Dindal designed the storyboards and art direction — based on an initial series of boards supplied by Joe Johnston — the animation production phase began. Cartoon animation, despite the development of digital cartoon work, is still largely hand drawn, the production process virtually unchanged since 1913 when animator Raoul Barre opened the first professional animation studio and pioneered the peg system to hold each page in register. Even for a short piece, the six to eight hundred animation cels required for the Nazi film was small compared to many animation projects, due largely to the stylized art design. "The visual images themselves, as far as concentrating on the things that count, represented a rather abridged approach to what we usually do on the traditional Disney animated feature," observed Dindal. "We didn't need the visual richness of a *Pinocchio*. Nazi propaganda films have a very definite artistic

style. Like the Fleischer cartoons, there's a little less to look at, but the strength is where it needs to be. The composition directs the viewer's eye to the focal point of whatever the scene might be. Although I drew all the animated elements, I had the help of two assistants, Dan Chaika and Steve Starr. James Beihold was a layout artist who drew the backgrounds, and Phil Phillipson was a background artist who painted that material. There were also about a dozen people in postproduction. The actual production entailed taking the animation paper drawings and xeroxing them onto cel material. The color — or, in this case, shades of gray — was painted on the back of those cels. Each cel was then laid down, one at a time, on registration pegs and photographed over a painted background."



In a bid to rescue his girlfriend Jenny who has been taken hostage, the Rocketeer boards the zeppelin and engages Sinclair in a furious fistfight as a fire in the gondola threatens to spread to the airship's hydrogen-filled envelope. Gaining the upper hand, the actor commandeers the rocketpack, straps it on and dives out of the gondola, unaware that the pack has sprung a fuel leak. When the rockets are fired, Sinclair is engulfed in flames.



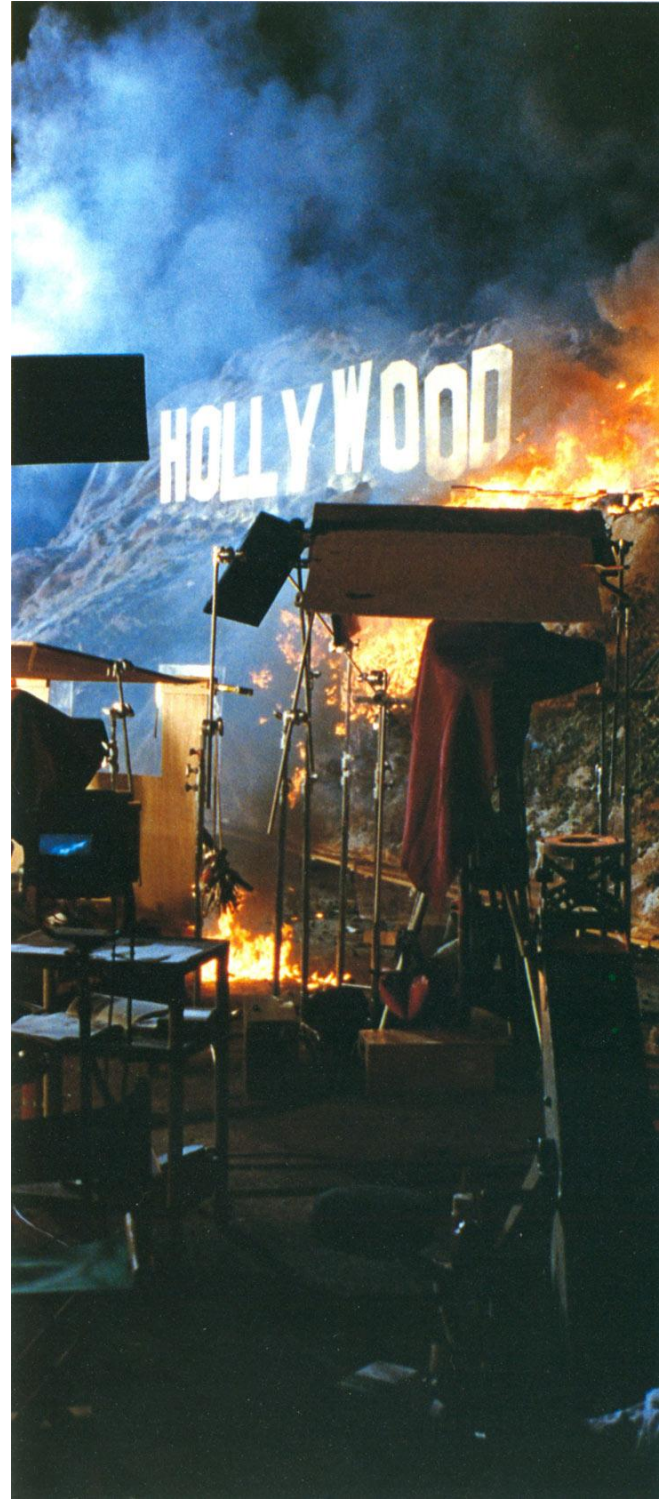
Actor Timothy Dalton gesticulates in front of a bluescreen for his character's fiery demise. Animated flame effects were added optically.



A famous Hollywood landmark is altered by the explosive impact of the rocket-clad enemy agent.

Some of the drawings were put in motion through tricks of the animation process. “The POV shot of the Nazis flying over a bombed-out city was a single drawing that the camera just panned over to give the illusion of motion, much in the way a motion control camera pass makes a spaceship seem to move. Their rocketpacks had a double exposure of the flame effect to make it look like the packs were firing. Another interesting effect was the scene where the flames consume the American eagle and transform into the German eagle. The flames were traditional animation; but there were seven paintings of the two eagles, and I just cross-dissolved between them to give the appearance of the American eagle transforming into the German eagle. We also put a rippled plexiglass distortion plate between the camera and the artwork to simulate heat from the flames.”

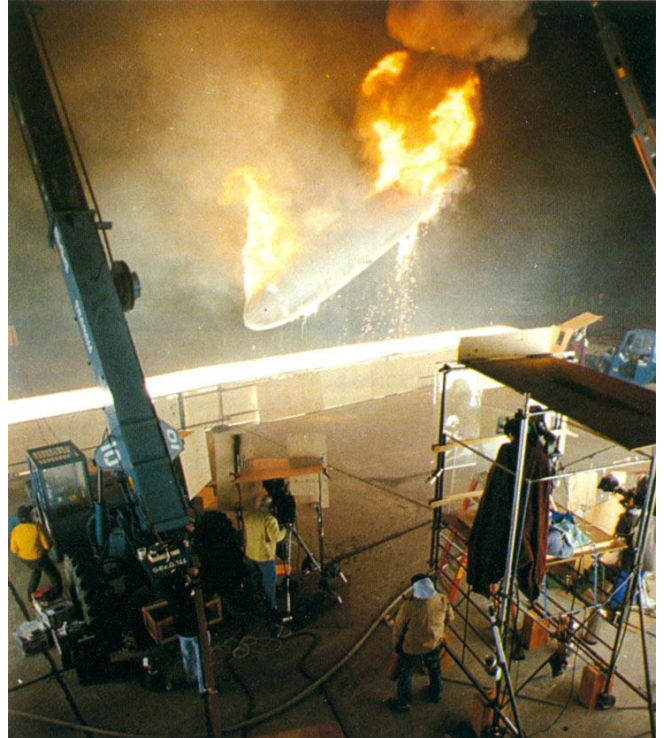
The Nazi film leaves Cliff unconvinced that he should surrender the rocketpack. Instead, he escapes from the Hughes hangar — using a small-scale ‘Spruce Goose’ mockup as a glider — and heads for the Griffith Park Observatory to rescue Jenny from Sinclair. In the climactic sequence, all parties converge, G-men and mobsters fighting side by side in a furious gun battle with Nazi soldiers. Sinclair and Lothar make their escape — with Jenny in tow — climbing up a rope ladder and into the Luxembourg, a gigantic Nazi zeppelin on a purported good will mission to the United States. “For the gondola set,” Belyeu explained, “we constructed a hydraulic gimbal that had a platform, about twenty by thirty feet, which was built on hydraulic rams that could tilt it and change its altitude at the director’s discretion. The motion had to be subtle or it wouldn’t work.” To enhance the motion effect, another element was added outside the gondola windows. “To create a horizon and add a sense of movement — of soaring over Los Angeles — we had to come up with something other than bluescreen,” recalled Jim Bissell. “We rented a backing of the Los Angeles skyline — one hundred twenty feet long by twenty feet tall — that was ostensibly painted for a house in the Hollywood hills, but was the



A tenth-scale hillside set was constructed at ILM and rigged with miniature pyrotechnics so the tail end of the ‘HOLLYWOODLAND’ sign would collapse on cue.

“We rented a backing of the Los Angeles skyline — one hundred twenty feet long by twenty feet tall — that was ostensibly painted for a house in the Hollywood hills, but was the

right location, altitude and perspective for what we needed. We took the backing and mounted it on a track so that during the shots we were able to move it slowly in the background.”



The thirty-four-foot Luxembourg model was transported to a defunct airbase where it was loaded with explosive charges and suspended by wires from a crane. To the dismay of all concerned, the charges fired out of sequence and the expensive effects shot was ruined — forcing a round-the-clock effort to build and shoot a second zeppelin in time for the film’s release.



Atop the envelope, and seemingly doomed by the advancing explosions, Cliff and Jenny are rescued at the last possible moment when Peevy and Howard Hughes appear in an autogiro and lower a rope ladder for them.

When the Rocketeer reaches the zeppelin, the shots range from stop-motion puppet work to live-action of the actor atop a full-scale mockup. To achieve a realistic impression of the character being buffeted by high winds streaming past the ship, the ILM optical department took the separate live-action and background elements and programmed their motion control optical camera to incorporate a set amount of shake into each element before the final composite.



Cliff and Jenny cling to the ladder as the autogiro peels away from the burning airship. The multi-element composite — matte painting background, high-speed pyrotechnics, motion control autogiro and bluescreen actors — was completed just days before the film was locked.

When the action shifts to the gondola interior, actors Bill Campbell and Timothy Dalton were called upon to stage a furious fistfight — a challenging stunt given the physical limitations and disorienting motion of the set. “The gondola set had a lot of sharp, metallic angles,” recalled Campbell, “and it was a real pain. The gimbal was continuously rocking back and forth, and the painted scrim of the Los Angeles skyline was moving outside — so it was pretty disconcerting. Amid all this movement we’d be tossing each other around.” At the height of the fistfight, Jenny fires a flare gun which starts a blaze that threatens to ignite the zeppelin’s hydrogen-filled envelope. In the confusion, Sinclair straps on the rocketpack, unaware that it is beginning to leak fuel. The villainous actor steps to the gondola portal and blasts off from the burning airship. As he rockets toward camera — with the Luxembourg in the background — the leaking fuel ignites, engulfing Sinclair in a ball of fire. Like a burning meteor, he plunges toward earth, hitting the ‘HOLLYWOODLAND’ sign with such explosive force that the ‘LAND’ portion of it collapses.

To achieve the effect of Sinclair’s Icarian fall, ILM photographed bluescreen elements of Dalton trussed up by wires, dangling, kicking and screaming. It was then up to optical to complete the illusion of a flying man aflame. “It was fairly challenging to get the character to appear as if he was in the flames and not just pasted onto them,” John Ellis recalled. “We did the shot on the optical printer with an overriding zoom on all of the animated flame elements to track with him, with the zeppelin in the background. Animation also gave us an interactive light pass so that his edges had a little bit of light effect. For the flame look, we ran the black center out of focus. That caused the matte to go soft around the edges so that when we put the flame pass in, it allowed the flames to creep around him a little bit.”

The Hollywoodland set was built in the rear parking lot at ILM. “Back in the Thirties, the hill was a little more barren and the letters were on wooden framing,” said John Bell. “Today the letters are reinforced steel and aluminum. We built a huge set — about tenth-scale — of the hillside and the letters. The real letters are actually fifty or sixty feet tall, so our letters were about five feet tall.”

“Stage technician Carl Assmus laid out the hill set with plywood and pipe and then sprayed it with urethane foam to give a rigid surface,” said Steve Gawley. “John Bell helped us dress the set and the pyro crew rigged the ‘LAND’ letters to blow up. We had miniature lights — the kind

you'd use in a slide projector — to light up all the letters, as well as other set lights. We were shooting high-speed, so we needed lots of light. The letters on the set were pinewood frames covered with miniature pieces of foil glued onto the wood so that when they blew up they would have a corrugated metal look. Since the 'HOLLYWOOD' letters didn't have to blow up, we cut them out of masonite. All the letters were painted white."

The climatic explosion of the Luxembourg — which would require the intercutting of miniature pyrotechnics with live-action work on a full-scale mockup — was based on the 1937 explosion of the Hindenburg. The Hindenburg, a gigantic eight-hundred-foot-long transatlantic dirigible built by the Nazis, was considered indestructible until an explosion ripped through its envelope as the ship was being moored at a landing site in New Jersey. Dick Dova, a longtime ILM stage technician, was actually present at the infamous disaster. "Dick was on the ground with his mother waiting for his dad who was aboard the Hindenburg when the thing blew up," Gawley related. "His dad had a movie camera with him and was shooting footage as the ship was coming in for a landing. Dick brought the footage in for us to look at. You can see the ground light up and things start falling before his dad threw the camera out the window and jumped — he was one of the few survivors. That footage gave us information about what happens to a zeppelin when it's burning. First the skin goes and you see the steel structure inside. Then the structure begins to collapse; and as the airship loses its hydrogen, and thus its lift, it starts to fall."

For the high-speed pyrotechnic work, a single Luxembourg model — thirty-four feet long — was ordered. Also ordered was a twelve-foot version for motion control shots that included the Griffith Observatory flyover. The large-scale model required six cone-shaped sections and ten bulkheads. "We cheated a bit in the construction," Gawley explained, "because real zeppelins are made out of triangulated flat pieces of metal that are riveted together. That would have been too heavy. Since we needed a lightweight airship, we came up with quarter-inch plywood for the basic skeleton. We designed it like a big puzzle. Each of the six different sections it took to make the zeppelin was made up of thirty-six 'stringers' that went lengthwise. We used the ten round bulkheads to connect the stringers. At its thickest point, the big zeppelin model was about six feet in diameter. We glued and stapled all the parts together."

The plywood puzzle pieces were cut to specification by Scale Models Unlimited, an outside vendor. By programming ILM's specs into their computer, the company was able to direct a laser beam to cut the plywood into the exact shapes required for assembly. The final stage of the construction process was laying a silver skin over the plywood superstructure. The required skinning material, a heat-shrinking polyester substance known as Solartex, was only available in the needed color and quantity from England. Normally that would have been no problem, but the model construction phase was underway during Operation Desert Storm and the British army had commandeered all silver Solartex material for its military operations. ILM was forced to order quantities of white Solartex, but even that involved an eight-week delay. "All packages coming to the U.S. were being thoroughly inspected because of terrorist concerns during the Desert Storm period," said Gawley. "After we finally got it, we painted the material silver and applied it by heat to shrink the skin and get it tight as a drum." The finished model — weighing

in at only three hundred pounds — featured practical lighting and motorized propellers and had five off-camera access holes for the placement of pyrotechnic material.

A full-scale mockup section of the Luxembourg envelope was built at Indian Dunes, a frequent filming location north of Los Angeles. The live-action and pyro work slated for it would entail three nights of shooting in bitter cold temperatures. The mockup design had to fulfill the script requirements of the doomed airship starting to nose-dive as explosions in the hydrogen bags begin to rip open the skin. “The art department built a Quonset-hut-shaped set about thirty feet high and one hundred twenty-five feet long, made of wood construction covered in fabric,” said Belyeu. “There were staircases built off the ends and out of sight so the actors could get on and off.”

At the fiery finale, Lothar, Cliff and Jenny have climbed from the gondola to the top of the envelope and are running in a futile attempt to escape the inexorable approach of the sequential explosions. Rather than achieving the effect by compositing separate elements of the actors and the explosions, Jon Belyeu and his crew undertook the shot as a live-action practical effect. A sequence of explosive charges were placed from three hundred yards away up to within twenty feet of the mockup. “Our mortars were steel pods full of gasoline and black powder,” said Belyeu.

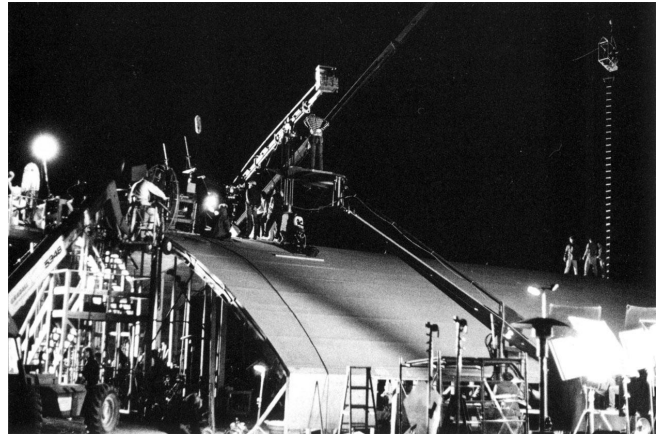
“The steel pods farthest away had the smallest charges and were twenty-four inches across at the opening and maybe thirty inches deep. Closer to the zeppelin, the mortars got as big as thirty-six inches across and maybe thirty-six inches deep. The charges were staggered; so as the mortars got closer, the size and intensity of the fireballs increased.”

“You could really feel the heat as the explosions began coming forward,” Bill Campbell recalled. “I guess the heat affected the air pressure because the skin of the zeppelin rose, raising all this dust, just like you see in photographs of mortar shells hitting an area.” Costar Jennifer Connolly found the experience exhilarating. “The sequence was amazingly exciting. Actually, I was utterly pleased when the explosions went off, because we were shooting in the middle of the night and it was cold. The explosions meant I would be warm for at least a minute.”



Suspended from a crane with his practical rocketpack firing, stuntman Mike De Luna soars past a full-size mockup of the Luxembourg tail as the Rocketeer overtakes the giant airship.

ILM's take on the exploding zeppelin was filmed at night at nearby Hamilton Air Force Base, a little-used military installation near the effects facility. The thirty-four-foot model was wheeled out on a cart to a forklift that lifted it up, allowing the pyro crew to implant their explosive charges. Once rigged and the access holes sealed, the model was then raised by a crane twenty feet into the air and suspended in the requisite nose-down position.



Despite painstaking preparations, the pyro charges misfired — a disastrous gaffe since Disney had ordered only one zeppelin model. “We always recommend to our clients — and we did to Disney early on — that when we’re working with miniature precision-oriented pyrotechnics, so many things can go wrong that it’s best to build at least two exploding models,” noted Patty Blau.

For scenes of the actors running across the envelope as sections of it burst into flame, the art department constructed a large outdoor set — one hundred twenty-feet long — comprised of a wooden framework covered with fabric. With the actors working in the foreground, large-scale background explosions were detonated in sequence from three hundred yards away to only twenty feet from the end of the mockup.

“But the zeppelin, being thirty-four feet long, was so huge and expensive that Disney decided to order only one. No one knows how it happened, but the bombs went off out of sequence. We immediately convened on how to deal with the problem and decided that building another zeppelin and blowing it up was definitely the best solution for the look of the film. Fortunately, we had bought enough Solartex to cover another zeppelin in case of emergency.”

ILM barely had time to build another large-scale model for a final pyro try. Steve Gawley and a crew of nine modelmakers spent five weeks, working day and night, to duplicate what had taken them four months to complete earlier. Even so, the retake was scheduled for May, mere weeks before the film's scheduled June 21 national opening. Ken Ralston asked John Ellis and his optical department not only to anticipate late bluescreen footage, but to prepare an optical fire effect using the twelve-foot model should the last-ditch pyro effort fail. “Prior to the second pyro work,” said Ellis, “we had started doing matte passes so that, if necessary, we would have been able to matte the small zeppelin model over the background and then match-move flame passes to it.” Luckily, the second pyro shoot produced spectacular footage. “If we had had to do the zeppelin explosion, it would have looked too much like an optical shot. It would not have had the look of this massive thing deflating as it’s blowing up. The second zeppelin worked really well. When the explosion goes off, you see the shock waves going through it and these wonderful gas balls and the burning skin falling off.”

As the Luxembourg explodes, an autogiro — piloted by Peevy and Howard Hughes — makes a flyover, dropping a rope ladder that Cliff and Jenny grab onto. The autogiro then lifts them up and away as the flaming, exploding dirigible drops out of the night sky. The shot, originally planned to be done practically with a real autogiro, for safety reasons was achieved as an optical composite instead. The ILM model shop built an eighth-scale autogiro, complete with puppet versions of Peevy and Hughes sculpted by Richard Miller. “The autogiro and the people

hanging on the ladder were two separate bluescreen elements,” said Ellis. “The shot of the actors on the ladder was sent to animation and they pin-blocked it so it would line up perfectly with the autogiro wing. Then it came back to optical and we made bluescreen elements from that.” The elements were a matte painting background — a piece of Mark Sullivan’s Hollywood skyline — the autogiro with light and prop passes, the zeppelin explosion and the bluescreen actors and ladder. “We also had to get a helper matte from animation for the zeppelin explosion. Because the pyro work had been shot at night against a black sky, we weren’t able to pull a matte from that explosion — there wasn’t enough contrast. For the areas we weren’t able to pull, animation came back and gave us a hand-drawn articulate to fill in those holes. Again, we had been preparing for this shot four to five weeks prior to the pyro work. Thanks to that preparation, when we got the exploding zeppelin element it took us only ten days to produce a final composite.”

In the aftermath of *The Rocketeer*’s release, Dave Stevens had occasion to reflect on his comic book’s beginnings and the painstaking effort by the filmmakers to retain its distinctive ambience of time and place. “All I wanted to do was insinuate this little, tiny story into the minds of the comics reading public and leave the impression that the reader had come across something that might have been printed fifty years ago, divorced completely from anything current. I wanted to build a feeling around the *Rocketeer* character that was sort of Paul Bunyanesque, that was Americana, a grass roots hero that really didn’t exist. That’s what a myth is, something bigger than life that really isn’t the guy, it’s just something that happens when the public finds out about it, takes hold of it and runs with it. It makes the character more than he could have been on his own — an icon.”

Stevens created his high-flying character as a window on a Thirties Los Angeles that mystery writer Joseph Hansen once wrote of as ‘the country of the mind’ — a time and place part history, part myth. We keep returning to this territory of our cultural memory, this time before the horrors of World War II, before the bomb made technology something to fear, before the malling of America. That far country, with all its promise and possibilities is as close as a dream. In that place, anything is possible — even the power of flight for men and women brave and bold enough to build silver birds to take them up and into the frontier of a wild blue sky. Maybe that’s why the cover for Stevens’ second chapter of *The Rocketeer* — with a picture of the *Rocketeer* rescuing Malcolm during Cliffs first rocket flight — has emblazoned over it the legend: “Stick with us — we’re making memories!”

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Production unit still photography by Ron Batzdorff. ILM still photography by Kerry Nordquist, Sean Casey and David Owen. Additional photographs courtesy of Steve Gawley. Special thanks to Lisa Van Cleef, Jill Jurkowitz, Howard Green and Steve Rogers.

THAT OLD BLACK MAGIC

article by
Kevin Martin



“In Los Angeles in 1948, everybody used magic.”

So begins the script for *Lovecraft*, a private eye yarn in the classic mold laced liberally with supernatural horror and offbeat humor. Produced by HBO Pictures as *Cast a Deadly Spell*, the made-for-cable movie marked the reteaming of producer Gale Anne Hurd with noted alumni from many of her earlier films. Selected to provide the visual effects needed to represent an alternate-reality version of postwar Los Angeles was 4-Ward Productions, headed by Elaine Edford and Robert Skotak, whose principals had contributed Oscar-winning work to Hurd’s high-profile productions of *Aliens* and *The Abyss*. Acting as visual effects supervisor for 4-Ward was Ernest Farino, who had participated in Hurd’s breakthrough feature, *The Terminator*. Line producer Ginny Nugent had held a similar position on the Hurd-produced *Tremors*; visual effects producer Laura Buff had served likewise on *The Abyss*; and Tony Gardner, who had assisted Stan Winston on *Aliens*, brought his Alterian Studios on board to provide special makeup effects ranging from pesky gremlins to the monstrous Old Ones, demonic beasts first described in the fiction of noted horror writer H.P. Lovecraft.

In the Joseph Dougherty screenplay, the like-named H. Phillip Lovecraft (Fred Ward), an uncompromising and hard-boiled private detective, is called upon to recover the *Necronomicon*, an ancient book containing the incantations needed to summon evil monstrosities back onto the earth from the subterranean lair in which they have been imprisoned for millennia. Lovecraft is chosen for this assignment because he, unlike everyone else in town, refuses to use magic as an aid. In the course of his pursuit, the detective encounters lumbering zombies, gremlins, oatmeal monsters, angry stone gargoyles — plus demons from his own past in the form of a duplicitous ex-girlfriend for whom he still carries a torch and a former partner from his days on the force who is now heavily into things illegal and very much interested in acquiring the *Necronomicon*.

“I wrote *Lovecraft* back at a time when I couldn’t get arrested,” Dougherty recalled, “and part of it was a pep talk to me. To an extent, the movie exists for one scene, which is when Lovecraft tells his old girlfriend why he doesn’t use magic. That’s me — in a Jackson Heights apartment without air conditioning — trying to explain to myself why the writing career isn’t going as well as it’s supposed to be.” The script was optioned and wound up in development at both Fox and Warners, but in a radically altered form. “Everyone said: ‘Nobody wants to see film noir. Nobody wants to see a period picture.’ So there were drafts of *Lovecraft* floating around that were set in *Blade Runner*-type futures. The time was changed from 1948 to 1999, but the characters still talked the way they do in the picture as it is now.” At one point, Rospo Pallenberg — a collaborator of director John Boorman on such fantasy films as *Excalibur* and *Exorcist II: The Heretic* — was brought in to rewrite the screenplay. His script also failed to secure a green light. One studio evaluation determined that *Lovecraft* could not be made for less than \$25 million. Eventually the option expired and the script reverted to its original author. No longer struggling in anonymity, however, Dougherty had prevailed as a writer and had earned himself both an Emmy and a Humanitas award for his work on *Thirtysomething*. Moreover, his *Lovecraft* screenplay was beginning to look good to executives at Home Box Office who were casting about for unusual feature projects that could be made specifically for the cable TV market.

The list of producers savvy enough to bring in a special effects period piece on a made-for-cable budget was short indeed; and before long, HBO was courting Gale Anne Hurd, whose no-frills approach to blockbuster filmmaking was as close to a guarantee for success as they could get. Once Hurd was committed to the project, Martin Campbell was signed to direct and the remainder of the creative team was assembled. The \$6.2 million budget, while high for a made-for-television film, was still considerably below that of most low-budget studio features. To insure that the limited funds were maximized, preplanning was essential — especially in the effects area. “We had a storyboard artist working with the director,” Laura Buff related. “In fact, Martin storyboarded every scene in the movie. He went in very well prepared, which was a necessity given our tight, thirty-eight-day shooting schedule.” Buff signed on early in the preproduction phase. “Gale sent me a draft of the script back in July 1990, and we broke down the areas where effects would be required. In that first script, things were considerably more extensive and complicated in terms of the visual effects — all of which were going to require optical work of one sort or another. We immediately began discussions with the director about toning that down because with budget and time restrictions it just wouldn’t have been possible to accomplish all of that. The screenplay was altered somewhat to minimize the opticals and bring the effects shots down to a reasonable number. The idea was to put our emphasis on the creature at the end and try to accomplish as much of the effects work in-camera as possible.”

The selection of 4-Ward Productions to supply the visual effects came as no surprise to Buff who had worked closely with the company during her months on *The Abyss*. “Gale has had a long relationship with Bob Skotak and his brother Dennis. They all worked together at New World Pictures for Roger Corman, and Gale has used them on practically everything she has done since. Bob Skotak is a big fan of H.P. Lovecraft and occult literature; and this film, of course, borrowed heavily from Lovecraft. Bob and Dennis met with us initially to discuss ideas and to determine how the plates should be shot. Ernie Farino supervised the plate photography during the live-action, and then went on to oversee most of the optical work done at 4-Ward. He also worked with Bob on determining which approach would be best for any given shot — whether to use matte paintings, miniatures, cloud tank work, whatever. Together they would narrow down the possibilities.”

Though Robert Skotak retained overall responsibility for the project, his hands-on involvement was limited because of overriding commitments to *Terminator 2*. “Ginny Nugent talked with my partner Elaine Edford, with whom she had worked previously on *Tremors*. When we initially bid on the project, there were more effects shots planned as the film was a little more ambitious in scope at that point. Some fairly extensive trimming was done — a number of shots came out.” Even after the sequences had been pruned, however, many difficult, but essential shots remained. “While the storyboards were being revised to take into account our cuts, the very limited budget got even smaller. In the end, more money was cut than shots, so we decided we would really have to give our all to make it work.”

The reduction in the number of opticals meant a corresponding increase in workload for physical effects coordinator Ken Speed. “For the various floating object gags,” noted Buff, “Martin chose to use magic tricks whenever possible. The production hired a stage magician as a consultant to help the floor effects guys rig some of the tricks and also to give them ideas for what was possible. There’s a lot of subtle stuff in the background — in the nightclub we have the drinks mixing themselves, and at the train station the luggage is moving itself along. Shooting things practically — getting the effects all in-camera — sometimes winds up looking better than what you’d get going the traditional optical route.”

To establish the bizarre alternate-past look of the film, a series of fantastic skyscapes was needed. “The production wanted a kind of stylized sky — a magic sky — and the idea was to use locked-off cameras on location and handle the shots as straightforward composites,” said Skotak. “There was a special mood established with these shots that showed this magical Los Angeles of the Forties. Generally we kept the people below the horizon line to avoid any complex matting. Rick Rische created the necessary artwork.”

The film opens on a rooftop, with an extreme down-angle on Mrs. Kropotkin — a state-registered witch and Lovecraft’s landlady — as she watches an eerie sky above. “The shot was done locked off atop a building in L.A. one night. One or two of the background buildings were actually lit by the live-action crew. The rest of the shot was built up with artwork — the lights of the city and such. The horizon was defined by artwork of clouds and put together optically — sort of like a sophisticated splitscreen. Since the locations had already been pretty much picked out by the production designer, our creative input was related primarily to defining the skyline and the clouds and enhancing the little bit of actual city visible in the plate.”

The action shifts to introduce Lovecraft, who has just closed another case for the police. At the same time, his former partner Harry Bordon (Clancy Brown) is closing a deal that he believes will bring him the Necronomicon, but instead brings him only a book full of blank pages. Angrily, he sends his henchman Tugwell after the man who double-crossed him, Mickey Lockstader. Accompanying Tugwell on his mission is an enormous and powerful zombie. Shipped six to a box from the West Indies, these animated corpses are cheap labor in a city accustomed to such things. “Initially we had a much bigger chunk of the budget set aside to do



Produced by Gale Anne Hurd for HBO Pictures, *Cast a Deadly Spell* good-naturedly mixes cinematic genres as it follows private eye H. Phillip Lovecraft in his quest to unravel a dark mystery set in a period Los Angeles where supernatural happenings are as commonplace as sunshine and palm trees. Among the many fanciful elements featured in the made-for-cable film is a unicorn being chased by a virgin huntress.

the main zombie henchman,” said Buff. “But when Jaime Cardriche showed up, his facial structure was so perfect that all we had to do was get him some contact lenses and put some ‘decals’ on his head. Tony Gardner took one look at him and said, ‘We just saved a lot of time in makeup.’ To be sure, we did a camera test before shooting the scene; but as it turned out, all of the prosthetic pieces we envisioned were no longer necessary since Jaime had such character in his face.”

Even though he did not have a lot of work to do to prepare Bordon’s zombie, Gardner and his Alterian Studios still had their hands full. “The variety of effects was exciting,” said Gardner, “ranging from unicorn headpieces to mechanically-assisted gargoyle suits. By the time we really got going, the production had storyboards for all the effects sequences, and this enabled us to sit down and discuss specifically what would be needed for each scene. That way, we could determine in advance what we could do without, which was especially important in regard to saving money and putting it back in somewhere else. What made it really great was that Ginny, Gale, and Martin trusted me and let me take a new slant when it came to designing a lot of different characters like the zombie from Jamaica. We put tribal scarring on his forehead, gave him weird eyes and teeth, and painted him much darker and blotchier.”

Tugwell follows Locksteader to a train station where Mickey intends to run off with a girl named Lily who is in possession of the real Necronomicon. But when Mickey spots Tugwell and the zombie, he waves Lily off and dashes into a nearby restroom. Tugwell follows, and blasts Mickey out of his hiding spot in a stall with a magic burst of fire. Locksteader offers Tugwell the package of money in exchange for his own life, only to discover that he, too, had been swindled — inside the package there are only blank papers. Tugwell continues with more black magic, creating a paper tornado that whips furiously around the petty crook, slicing hundreds of cuts into his flesh.

Tony Gardner contributed to the design of the rig used for the effect. “My original concept was an open-weave wire basket with papers attached to it, which would be either on the floor or suspended over Mickey’s head, spinning. We were going to squirt blood through this thing and down onto the actor to make it seem as though cuts were appearing. In the end, the floor effects guys built a couple of wooden hoops on a motor which hung from the ceiling. There was monofilament line between the top and bottom hoops which hung straight down. When the rig was turned on, the bottom hoop would ride a little behind the top one, so it was on a diagonal and gave the illusion that everything being whipped along was moving upward as it spun around. Bits of paper were blown through this rig for most of the shots in the sequence; but for the beginning of the scene, the effects personnel brought in some huge fans and installed them above the actor. During the shot, they actually threw the paper into the fan, which blasted it down past the actor onto the floor. When the film was reversed, the paper rose up like a column around the poor guy. Later, when they went in for closeups, we suggested putting facial cuts on the off-camera side and then having the actor simply turn into view. With the little paper pieces whipping along, coupled with sound effects, the illusion that he was being sliced up was a convincing one.”

The following day, Lovecraft is summoned to the home of the wealthy Amos Hackshaw (David Warner). Establishing shots of the mansion were again photographed as lock-offs, with fanciful

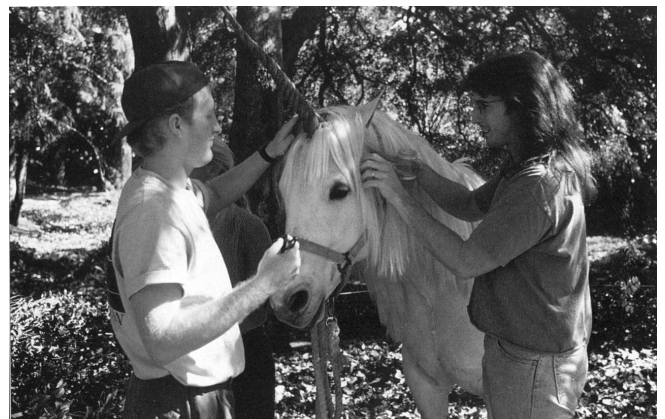
painted skies later added to create an ambience of magic. As Lovecraft drives through the stately grounds, he encounters a unicorn being pursued by a beautiful huntress — Hackshaw's daughter Olivia (Alexandra Powers). Converting a horse into a unicorn was a task that fell to Tony Gardner. "Because of the type of horse that was used, the mane was only about eight inches long, so we had to braid the animal's actual mane and clip a three-foot fake mane onto the braid so the hair would go down to the base of his neck. We had to do a partial head cast on the horse for the plate which held the horn. The horse didn't take to that very well at all. Kevin Hudson used foil to build a form up on top of his head to get the shape, but I had no idea just how skittish horses can be. I had done a body harness once on a lion that was supposed to have wings, and that turned out really fine; but with this horse, the reflection off the foil as it came towards his eyes really seemed to freak the animal out."

Once inside the gloomy mansion, Lovecraft is told by Hackshaw about a former employee named Larry Willis, who has purloined his treasured Necronomicon. Hackshaw also hints that Willis had designs on Hackshaw's daughter who is sixteen and still a virgin — a rarity in these parts, even in 1948. Lovecraft accepts the proffered assignment to find and return the Necronomicon by midnight Thursday — two days hence. He departs the mansion amid a strange red rain — an effect which again was accomplished on location by the physical effects crew.

The Hackshaw estate is crowned by a hideous stone gargoyle that opens its eyes and glares balefully at Lovecraft as he walks across the drive to his car. Conceived as a creature point-of-view shot, the distorted gargoyle vision was accomplished simply enough by using filters and wide-angle lenses on the main unit camera. The number of gargoyles, as well as their final appearance, were two points which changed during preproduction. "At first there were supposed to be two gargoyles," Joseph Dougherty explained, "but the pricetag was too high, so the script was revised to consolidate them into a single beast. Also, my original concept was to use dimensional animation. But again, with this budget, that just wasn't going to happen. So the gargoyle was reconceived for an actor in an articulated body suit."

The makeup unit was charged with producing the gargoyle suit based on a series of conceptual drawings prepared by the art department. "We kept certain key design elements from one of the drawings the production office gave us," noted Gardner. "There was an element of asymmetry — a crack in the face, with one eye shifted — which gave the gargoyle kind of a Quasimodo look. At first I wasn't particularly keen on that — but it worked out okay."

Lovecraft visits Willis' last known residence — a run-down rooming house tended by a grizzled old landlord. The man is busy battling some bothersome gremlins which he grumbles were brought back from the Pacific by GIs returning from the war. "The initial design sent to us looked an awful lot like the mogwai from Gremlins," Gardner recalled. "The anatomy was almost exactly the same, and so was the color and length of their fur. So I had to tell them that I just



[illegible]

Mackay in the film a partial head cast of the unwilling animal in order to produce a firm-fitting anchor plate.

a photograph of Mickey with Lily. But a
 into paroxysms of rage. The battle is
 his time, the man has a shotgun which he
 self of the shrieking creature.

s body functions operate via cable controls, We also had separate closeup heads for the puppets. For scenes of the gremlin in the poor up off the ground about six feet and just the director. As the scene progressed, we we could operate our puppets. By the end At one point in the battle, the tiny creature t puppet, which was just the lower two- s which extended backstage so that when I would move in a corresponding manner. It irect drive." Additionally, a mechanism was to wag its tail.

emselfs, Lovecraft finds himself having
r. When the food bill is presented, the
n the reverse side — courtesy of Tugwell,
craft spots the tiny writing — which clearly
rsues the manager into the kitchen where a
ertently grabs hold of the check, the demon
t of oatmeal. “We had a five-gallon pot of
e were supposed to puppeteer this demon
ion and a lot of research and development
e had oatmeal flying all over the camera and
ersion of the oatmeal demon — he’s the one
so he deserves special credit.” After the
he restaurateur. For this scene, a closeup
n Sercelj, an actress whose very thin arms



Mauled by a demon that leaps out of a pot of bubbling oatmeal, a hapless restaurateur lies dying on his kitchen floor.



A sullen werewolf undergoes interrogation at a downtown police station.

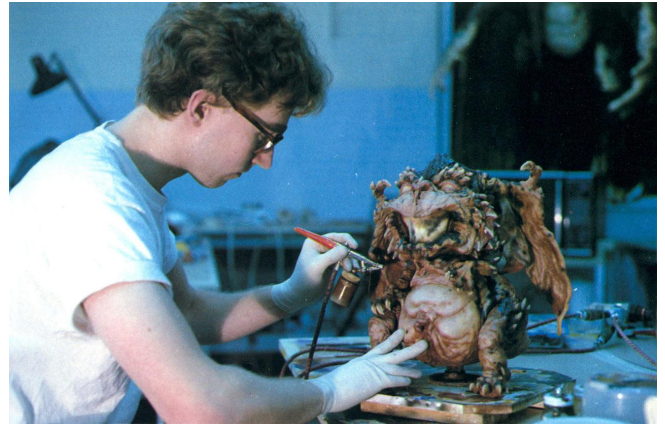


Seeking clues to the whereabouts of a key suspect, Lovecraft pays a visit to the man's landlord who is bedeviled by gremlins that have taken up residence in his car and home. The 'hero' gremlin that confronts the harried landlord inside the house employed cable controls to effect its gross body movements and radio control for its head and facial articulations.

Early in the altercation, the monster comes leaping out of the pot right at the terrified manager. The shot was designed to take place from the man's point of view; and to accomplish this, an unusual apparatus was devised by Gardner and company. "We built a rig with thirty feet of steel pipe which extended through the back wall of the set. The puppet was attached at one end of the pipe, with us on the other end and a fulcrum in-between. We actually threw the whole thing at the camera — javelin-style — and the puppet itself served to block out the pole from the camera. It took us forever to get the shot just right, because if the steel pole was pushed out a certain way, it would start to bow, so we had to compensate for that. Then there were times when we did it too well and the demon would hit the camera." Lovecraft, wielding a cast iron skillet, finally manages to bat the creature into a walk-in freezer; but it is too late for the greedy manager, who has been severely wounded by the creature and dies. The scene allowed Tony Gardner to make a nodding reference to his own work on another recent film. "We ripped all the skin away from the victim's mouth — that was kind of an intentional reference to Darkman — then we actually used Darkman's gloves for the manager's torn-up hands. It was our little homage." The creature finally dissolves back into mush as the check spontaneously combusts, leaving no evidence of the black-magic murder.

"In the script," noted Gardner, "both the gremlins and the oatmeal demon were kind of just throwaway characters, and we were allowed to elaborate on their appearance and size. Martin had never worked with effects before, so I was asked to help out on the set while these things were being shot. We were really able to control the look of the effects we were producing, from the earliest drawings right through what you see on the screen. There was a lot to do, but everything was kept well integrated into the story — it wasn't a case of 'Stop the show, here's something weird.' Everything was treated matter-of-factly."

Lovecraft is taken to the police station, where, as he awaits his turn under the hot lights of the interrogation room, he spots a prostitute in a cell across the way. A lady of the evening — in more ways than one — she flashes Lovecraft a beckoning smile that reveals long vampire's incisors. A howl comes from the interrogation room, where a police lieutenant is hard at work grilling a suspect — who just happens to be a werewolf. Both the vampire hooker and the werewolf were fairly straightforward makeup applications. "We made dentures for the



Garret Immel airbrushes coloration and details onto one of the finished puppets.



Five gremlin characters were produced by Alterian for the film.

hookers,” said Gardner, “and were told to make a standard long-snout werewolf — more modern-looking than traditional. Since this was supposed to be a period movie, I asked Martin if he had ever seen *I Was a Teenage Werewolf*. I envisioned the Lovecraft werewolf as more of a pug-nosed, flat-faced wolf in that old movie style. Martin agreed with that. I also suggested the wolf be a bum or a street fighter, with cut-off gloves and facial scars — just plain ratty looking. Martin thought this was a really good idea, so we went with it,” The only difficulty with the scene was that the harsh light of the interrogation room made it very difficult to keep the makeup from looking too obvious. “We had a big flat light on his face, and unfortunately the makeup ended up looking orange as a result.”

Bailed out of jail by his landlady, Lovecraft heads out of town to investigate Vista Bonita — the housing development mentioned on the flyer he found in Larry Willis’ room. Scripted scenes depicting the construction of Vista Bonita were simplified in order to minimize opticals. “In the script,” said Dougherty, “the original intention was that Vista Bonita was building itself. You would see building supplies flying out over fields and out past Los Angeles, and houses and various other structures would be putting themselves together. It would have been nice to do, but the cost was really prohibitive. We replaced that by having the zombies perform the actual construction of Vista Bonita.” A partial set was erected to represent Vista Bonita under construction, and a matte painting was used to extend the incomplete surroundings.

“There was a live-action plate of Vista Bonita,” explained Bob Skotak, “a wide shot which included two partially constructed full-scale houses. We painted in the rest of the terrain and housing. It was a difficult shot to pull off under those circumstances, because of the stark, wide composition and the stylized nature of the set. The live-action segment was actually shot on stage with a mixture of indoor lighting, and we had to take that and integrate it in such a way as to make it look like daylight and cover for the fact that the hard shadows you’d get at a real desert location weren’t there. To explain the soft shadows from the stage lighting, we wound up painting in some wispy clouds that acted like diffusion in the sky.” In postproduction, another rethink of the painting was made, leading to an optical enlargement focusing on the live-action element. “Even though we followed the storyboards provided for us, HBO was not happy with the design of the shot, inasmuch as Lovecraft was very small in the frame — which is why they wound up deciding to blow it up. Even now, the shot is pretty wide; but before, it was really wide. You could barely see Lovecraft, especially if you were going to be watching on a nineteen-inch television. In my opinion, the final shot was printed down a bit too dark. For a day shot, it just doesn’t have that luminosity you’d expect to find in a bright desert.”

Lovecraft trails the mysterious Lily to a seedy hotel room and recovers the Necronomicon. Lily, who turns out to be Larry Willis in drag, explains that Vista Bonita belongs to Harry Bordon and that Amos Hackshaw is very interested in the property — and that his interest ties in with his need to possess the Necronomicon for a special midnight ceremony. Before Lovecraft can get any additional information, Hackshaw’s gargoyle bursts in through a window. Air cannons were used on the set to simulate the effect of the stone beast hurtling into the room. The winged monster advances on Willis, intent on silencing him.

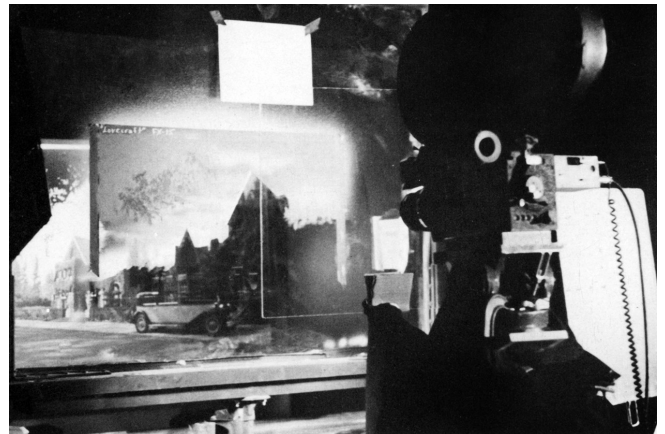
The gargoyle suit featured an innovative mechanism for producing unobstructed wing-flapping on stage. “It was a matter of wanting to do a self-contained wing mechanism for the suit,” said Gardner, “primarily because I’d never seen one. David Penikas designed a backpack with an air cylinder inside it that was worn by Mike MacKay, the actor inside the suit. By way of standard radio control, we could make the wings do whatever we wanted. Mike was able to walk around without having to worry about tripping on cables or having them show up in the shot. David Penikas also designed the self-contained gargoyle wings, which worked without a hitch during shooting. Brian Penikas and Eric Fiedler assisted on stage with the assembly and puppeteering of the gargoyle suit. When you’re working with the live-action crew — especially on a show that is scheduled as tightly as this one was — the last thing you want to do is slow things down or keep everyone waiting. Brian and Eric were terrific about making sure we didn’t cause any additional downtime between setups.”

After emptying his revolver in a futile attempt to prevent the gargoyle from killing Willis, Lovecraft manages to stop the advancing stone behemoth with a kick to the groin. Leaving the creature grimacing cross-eyed in pain, Lovecraft escapes with the Necronomicon only to lose it moments later to Harry Bordon who has a midnight rendezvous scheduled with Amos Hackshaw at the Vista Bonita construction site. There the wealthy eccentric intends to perform the ancient ritual that will bring the Old Ones back into power. The ceremony requires the sacrifice of a virgin, but Hackshaw is prepared to surrender his daughter in exchange for unlimited eternal power. Lovecraft stands helpless as Olivia is brought forward and Hackshaw begins the invocations for this dark ritual. Lightning fills the night sky. Repeated bolts strike the earth surrounding a hilltop gazebo which stands before the frightened onlookers. Suddenly the ground begins to shake and giant rifts appear before them.

To realize the end sequence, a large miniature representing Vista Bonita was constructed at 4-Ward Productions under the supervision of chief modelmaker Jim Towler. “One of the first



As the film approaches its finale, Lovecraft and his ex-girlfriend (Fred Ward and Julianne Moore) observe as the wealthy Amos Hackshaw attempts to conjure up the fearsome Old Ones from the subterranean vaults that have imprisoned them for centuries. A zombie thug was effected rather simply by applying facial makeup and contact lenses to actor Jaime Cardriche.



4-Ward Productions was commissioned to provide opticals and miniatures for the film. Among the tasks assigned to them was the incorporation of eerily colored skies into a number of master shots. These ‘magical’ skiescapes — including an early one over the brooding Hackshaw Manor — were rendered as matte paintings by artist Rick Rische.

things we did was go down to the live-action location in San Pedro and scale out some of the houses. Only what shows up on camera was actually built. Some of our houses were three-sided, or even one-sided, and so foamcore was perfectly adequate for this purpose.” Detailing costs were contained by painting the houses and then drawing on roofing and shingles with chalk.

The size of the miniature became an issue when it threatened to exceed the available stage space. “The set was constructed at quarter-scale, because that was what the monster was being built at. Originally it was planned to be a smaller size, but since the creature scenes were going to involve smoke and steam effects, it was decided that the larger scale was the best way to go. The model ended up being built atop a three-foot platform and was about forty feet square — and this is in a room that was not a whole lot larger than that, maybe fifty by fifty. So there wasn’t much space to move around. In a way, it was good to have the miniature that large. It’s hard to go wrong at that great a size because the actual physics of the simulated event are close to what would really happen in a full-sized situation.” The set was elevated so as to allow the Alterian creature operators — and members of the 4-Ward crew — access from beneath for operating the creature and assorted ground-moving effects.

“The first thing we made for the model was a series of long troughs that would run the length of the ground fissure once it had opened. They looked like canals, and were made to slide out like drawers. During the shoot, we had a man on either end operating a drawer; and when the cues were given, the drawers would be pulled out and the earth inside would pour down and out onto the stage floor. We also had red-gelled lights mounted underneath the cracks so that as the earth fell away, a red glow would come up out of the ground.”

For the earth-splitting arrival of the representative Old One, slot-gags were built to create the impression of furrows forming on the landscape surface. “Jim Towler made trapdoor sections on the hillside,” Bob Skotak revealed. “They were constructed from chicken wire, plaster, Astroturf and grass. The loose dirt was filled into sections and covered with grass, and then a slotgag was used to create the actual fissures.”

Since steam had been employed during the live-action shoot, its use was pretty much mandated for the effects crew who needed to duplicate the look of what had gone before. “We had to use real steam,” stated Towler, “because the look of steam would have been difficult to match using another technique. Steam has certain characteristics that you just can’t get with Mole smoke or foggers. The pyro guys, Joe Viskocil and Emmet Kane, had rigged some long pieces of copper tubing with holes in them. Off-stage was a boiler, and they would turn up the steam which served as the primary means of generating the smoke that came up out of the chasms. So before the cue was even given, they would fire up the steam which would be underneath the earth and would start mixing with the vermiculite. Then, once the drawers were pulled, the ground would fall and the lights would be brought up on dimmers.”

Two takes were required to capture the earth rupturing open. Each was covered by two cameras — one wide and one up close. “The only adjustment we had to make was to get the cracks to open a little more irregularly. Not all of them opened at the same rate and at the same time. But it was such a pain to refill those things that it seemed to take all day to get set up for

that second take. We must have used forty full twenty-five-pound bags of vermiculite. And when dumped, it would go all over the stage floor, get under the lights and create an enormous mess. We had a team of ‘vermiculite wranglers’ who would get underneath with shop vacs and then redress the set.” Prior to making the shot, there was an air of apprehension among the crew due to the materials involved. “It was a little tricky, because we didn’t know if the steam mixing with the vermiculite would cause a problem. Vermiculite is this weird spongy material; and we feared that if it got wet it might bind with the drawer slides — but fortunately that never did happen.”

There were problems with the steam effects, however. “When we rehearsed the thing, late in the evening, the steam came right up and worked just great. But when it came time to do the actual shot, the steam effect was barely visible. Finally we realized that the stage was too hot. We had had the stage lights on all day and the temperature of the air was affecting the visibility of the steam, making it register to a much lesser degree than it had during the testing. We wound up keeping everything shut down until just before we were ready to roll. Then it would be ‘Lights, Camera, Action’ and we’d do the scene before things would heat up too much again. It made a really big difference in terms of what we were able to see on camera.”

The storyboards called for a bird’s-eye view of the gazebo — a decidedly non-standard view when shooting miniatures. “Normally it’s hard to get a down-angle on a miniature to work,” observed Robert Skotak, “but for some of these shots we had the locked-off live-action element, which really helped to sell it. Also, Mark Shelton did the lighting, pretty much following the live-action and scaling it down so that it looked like a real environment lit by studio light. In order to make it look real, we actually had to make it more artificial. Very often you will find that these types of shots are lit in a way that nature would light things, but we don’t have a frame of reference for that because it is not possible to photograph. We tried to hit that perfect combination of moonlight and artificial illumination — which again is not necessarily realistic. If we had shot in a real courtyard at night, we’d still have had to use lights to bring the illumination up to an acceptable level.” In order to accomplish the down-angle shots of the gazebo and its surroundings, a scaffolding was built which allowed a camera to be mounted above and shoot down directly onto the miniature stage.



Yog-Sothoth — the gigantic Old One sent forth to reclaim the earth for his kind — was constructed by the Alterian crew from flexible urethane. Although varying designs were proposed and considered, the final concept was derived largely from the descriptions of supernatural beasts found in the horror writings of H.P. Lovecraft.

Since the gazebo needed to explode, a hero model and two backups were constructed. “The gazebos were about five feet tall and four feet wide,” said Towler. “Dennis Dale did a lot of the work on them. Two were strictly balsa wood and designed specifically for the explosion shots. The third was our hero model, which we were able to disassemble. That was made of balsa wood and foam. At one point, the gazebo is distressed and teetering, so we used the hero model there because it could withstand the stress of being skewed.” The balsa wood blow-up models were scored with cutting tools to facilitate their demolition. Joe Viskocil and his crew laced the miniatures with explosives and the detonation was filmed slightly overcranked to enhance its apparent scale. For reasons of safety, the crew left the building prior to the blast. “We watched the explosion on video from outside. It was from a weird angle with the camera way up on a crane arm. It was quite a blast. In dailies, we saw the model sitting there for a minute, then a giant flash — and nothing. The gazebo was almost completely destroyed. The biggest piece I found was only about two inches long.”

After the gazebo blows up, steam rising from the pit temporarily obscures the surrounding area. “At first, all you can see are spirals of smoke coming up out of the newly formed crater. Then we slowly reveal the monster — first just the details — its eyes, mouth and tentacles just barely becoming visible through the smoke.” Olivia is thrust before the demon beast, at last revealed in full, and the Old One snatches her up.

The design of the creature — identified by Amos Hackshaw as Yog-Sothoth — began with literary sources. Production designer Jon Bunker contributed some early drawings. “The initial inspiration was from several H.P. Lovecraft stories,” recalled Tony Gardner. “There was some mixing and matching of different characters and looks before we came in and contributed a few designs of our own. We did some research on squids and octopuses, and studied lobsters and crustaceans with the idea of combining elements from two different types of creatures. Then the budget for the creature was cut in half, and we had to completely change everything to accommodate this development. From that point forward, we went with the basic shape that had already been settled upon, then tried to add as much as we could with the amount of money that was available.”

Although the full creature was achieved only in miniature, Gardner and his crew needed to supply some full-size tentacles to interact with the live-action performers. “The tentacles had to whip through the grass and wrap around the actors. We had mechanical tentacles and positionable ones, as well as some loose-jointed ones with smoke tubes routed through them.” A smoke effect was needed for the moment after Olivia has been scooped up by the creature — contact with the girl causes Yog-Sothoth’s tentacles to burn — and the monster, bellowing its displeasure at Amos Hackshaw, abruptly drops her and starts thrashing about.

Arranging the miniature set so that the Old One would have sufficient operator room was a bit of a trick for Jim Towler. “I had to start working on the landscape model at a time when they were still building the creature. The difficult part of it was when the monster comes up out of the ground. Half of it was still supposed to be out of view underneath, and the ground had to fit snugly around the body. I took measurements when I went to Alterian and I sketched out the proportions of the monster; but until we actually had it on the set, we didn’t know exactly how

well it was going to fit in. The space confines were so severe that we had to have the background houses up on stilts to make them mobile so we would have room and could get the creature in and out. The same thing happened anytime we had to move a 10K or an arc light by. We had to be able to get to all of these pieces quickly and move them up and out of the way, then roll them back into place again.” Things were equally close underneath the set. “At a couple of points, we had a half-dozen people underneath the center of the mound. Everyone was crawling around on their knees; and throughout the shooting, the guys from Alterian were always saying, Hey, can we remove some of these two-by-fours and stuff?’ So reluctantly, we wound up chipping away at this thing from the inside out in order to give the creature operators more space. It made the set kind of tricky to walk on in some places.”

The creature itself was made from Skinflex.” Tony Gardner revealed, “which is a really toxic urethane that leaches chemicals. It was six or seven feet tall and maybe six feet wide — so it wasn’t very miniature at all. We had two people inside it, one of whom handled the gross body movement while the other wore a mechanical glove extension that was the mouth. Hydraulics were used for breathing effects and some of the major body movements. The eyes and the little ‘feelers’ — many of which were on the creature’s underside and went unseen — were radio controlled. The creature also had weird, octopus-type tentacles that we called ‘croissants’ hanging off each side of the mouth, which wound up being cable-controlled because they were really large and needed a lot of torque.”

Since the storyboards specified closeup views of a giant eye, Gardner spent a considerable amount of time evaluating how best to simulate a real eyelid on a large scale. “The eyes were really huge! The first time you see the creature — just as the smoke clears — one eye opens and it blinks a few times. When you’re handling something like this that winds up being the size of a softball, you need to make it look flawless. Bill Sturgeon and David Penikas wound up having to design a special eyelid mechanism for it that matched the contours of the resin eyeballs we built. Part of the mechanism was metal and part was spandex so that there was a flex to it. It actually glided across the surface of the eyeball with the foam eyelid glued atop of that. For a lot of mechanical creatures — the gargoyle being a good example — there’s always a little bit of a gap between the eyelid and the eyeball. No matter how much silicone fluid you put in there, you can never get it perfect. This is the first time I’ve seen something that so closely resembles a real eye. The only weird thing about it was that the eyeballs wound up being seven inches across!”

“There was a speed-rail rig underneath the creature, supporting it,” Towler noted. “The rig itself — on rollers and counter-weighted at the far end in a sort of teeter-totter arrangement — extended out about six feet from the monster. So the whole setup was really tremendous, with a half-dozen people beneath the creature, two others inside of it doing some operating and a few radio control people working other pieces.” To facilitate the Old One’s movements, additions were made to the device used to lift the two-hundred-pound creature up and down on cue. Even with the accurate preliminary study he had made of the creature’s size and shape while it was still under construction, Towler found himself having difficulty getting everything to fit in the limited space available. “With that unit in place, we had to make the back half of the set — with

the gazebo and the houses — so it would slide out in sections, like slices of pie, in order to just get the creature into position. Then those sections would have to be redressed.”



A housing tract still under construction was the specified site for the appearance of the Old One. The live-action setting was duplicated in miniature — on an elevated platform at 4-Ward Productions — under the supervision of chief modelmaker Jim Towler. A central mound — topped by a quarter-scale gazebo — was rigged to split open and reveal fiery glows emanating from beneath just prior to the explosive arrival of the Old One.



Effects supervisor Ernest Farino oversaw most of the 4-Ward shoot. Two creature crew members were inside the urethane behemoth and a half dozen others were underneath the set operating an array of cable actuators, hydraulic mechanisms and radio control devices.

The Old One, angered by its inability to consume Olivia — whose virginity, unbeknownst to her father, is no longer intact — instead grabs Hackshaw and proceeds to gobble him up before sinking back into the pit. At the same moment, the turbulent air begins to clear, Bordon's zombie slave topples over and Hackshaw's gargoyle becomes rigid and then dissolves into thin air. The supernatural threat is over.

When the creature had to sink into the ground and withdraw, the problem of available space surfaced yet again. "The creature guys had to back their whole unit out of the model," said Towler, "and there wasn't clearance behind for it. We had to decide whether to cut part of the creature or cut part of the set — which would still be required for an additional shot after the creature's removal. We ended up compromising. I've worked on creature shows before, so I guess I'm a little bit pro-creature. We were able to cut away a bit of the set — just enough to allow the creature to sink into the hole. As it turned out, a lot of the camera angles were changed late in the show, and it wound up not being necessary to see much of the area of the set I had destroyed — so in the end it worked out fine."

As the postproduction phase drew to a close, the Skotak brothers and director of photography Jim Belkin — at last relieved from the bulk of their Terminator 2 responsibilities — joined to complete the Lovecraft effects shots. "Ernie Farino ran into a time crunch," Bob Skotak reported. "So with Jim Belkin, my brother Dennis came in and completed the three wide down-views of the monster coming out of the ground with the actors responding to it. The live-action set was pretty small — a couple of houses and part of the hill — so when we did that shot looking down on the gazebo where the ground has cracked open from lightning, we had to blend their partial full-scale set with our miniature. Occasionally there are problems with shots, and in this instance we had these three down-angle shots with matte line problems; so we switched our approach to the shots and put them together on a process screen, adding just a tiny bit of artwork to make it all blend together." It was a technique the Skotaks had used often



Tentacles extruding from the beast draw a puppet version of Amos Hackshaw into its fearsome maw.

— perhaps most notably on *Aliens* and *Terminator 2* — of combining various film elements in-camera through the use of a beam-splitter.

“It was a really unique way to put together a shot we had a lot of problems with,” Laura Buff admitted. “4-Ward also composited the daylight matte shot of Vista Bonita, with the house and the magic sky, using a similar method. Many of the creature shots were cut for dollar reasons. We wound up slaughtering the effects budget as well. Martin had to get really judicious about which scenes would absolutely need these magic sky shots. In general, we had to scale everything way back. As a result, we ended up with about thirty-five effects shots in the entire film. Earlier we had planned for maybe fifty shots in just the final sequence alone. We had to pick the shots that were necessary to tell the story.” Practical realities — in the form of time constraints — also conspired to whittle away at what could be accomplished. “When shooting these creatures, you deal with puppeteers who are trying to get everything to look in scale and move well and be properly lit. Doing that is really time consuming, so a lot of the shots of the Old One had to be eliminated.”

Contrary to expectations, Tony Gardner found that the financial limitations imposed on the makeup department may have served as a spur to creativity. “The whole show was, for us, an experiment in money management as well as creativity. We were forced to work within strict financial parameters, but after awhile it started becoming more of a challenge and less of a burden.” One of the biggest headaches for the makeup contingent came after the shooting had been completed. “We finished photography with the creature and brought it back to our shop — where it wound up sitting out in the middle of the floor — then had to wait for the footage to be approved before we could get rid of it. It was a huge toxic thing, and I really wanted to destroy it immediately, but we had to be sure first that there was no chance of reshoots.”

Shortly before its September air date, the film underwent a name change, purportedly because prospective viewers saw the title and anticipated some sort of cruise ship romance. After considering several alternatives, *Cast a Deadly Spell* tested favorably and was consequently selected. Viewer response to the initial showings was so strong that HBO promptly announced that a sequel was in the offing. Joseph Dougherty found the prospect appealing. “After all, it can’t be that easy to destroy the Necronomicon. I’ve had very casual discussions with Gale Hurd and Martin Campbell and Fred Ward, and we’d all like to do another with the same team.” So the future of genre projects at HBO is wide open. In addition to *Cast a Deadly Spell* and the possibility of a sequel, Joseph Dougherty has already proposed a remake of *Attack of the Fifty-Foot Woman* to the cable network. The feeling at HBO is that as long as the quality of the projects remains high, talent will continue to be attracted despite the limitations imposed by the nature of television.

For Dougherty, one of the supreme pleasures of *Cast a Deadly Spell* came not at the end of the production but at the very beginning. “I think the real surprise came when we all sat down and listened to the cast read through the script for the first time. This was just before the start of shooting, and for some reason I hadn’t realized that we were making such a bizarre film or that it was so funny. It had never occurred to me that people would find this an odd world, because to me it all made perfect sense. But just sitting there listening to people talk about gargoyles

and demons from the pit of Asygoth in this Chanderlesque tone, entirely deadpan — which I suppose is the reason it does work — that was just the most amazing experience.”

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